ORIGINAL ARTICLE

Audit of Admissions and Discharges of Intensive Care Unit at a Tertiary Care Center of Northern India with American Critical Care Medicine-2016 Recommendations

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Abstract

Background: The intensive care unit (ICU) is an area within a medical facility equipped with advanced technologies such as ventilators and personnel trained to provide intensive, advanced life-supportive care to critically ill patients. These units can be general or specialized. Intensive care beds are always in demand in any tertiary care center. Getting ICU beds is a challenging task. In 2008, the cost of critical care was 17–39% of hospital costs and 5.2–11% of the total healthcare budget. On one hand, where needy patients do not get ICU beds, there are instances when patients are kept just for observation in intensive care. So, we planned this study to analyze our status regarding the effective utilization of medical intensive care beds.

Aims and objectives: To audit our admissions and discharges on the grounds of the criteria laid by the American Critical Care Medicine (ACCM) in the year 2016, and to strengthen our admission and discharge policies with standard protocols to make the best utilization for society.

Materials and methods: Retrospectively, we analyzed the medical records of 6 months (July 1–December 31, 2021). We analyze admission criteria and discharges in those patients. We recorded the sequential organ failure assessment (SOFA) score, the quick sequential organ failure assessment (qSOFA) score, the length of stay in ICU, the total length of stay, and the outcomes of the patients. The analysis was done with SPSS.

Results: We collected records of 355 patients admitted in the medicine ICU during the defined period. There was a male preponderance in our study. The mean age of patients admitted was 54.75 ± 17.53 (range 16–82). Most patients were transferred in from the ward (53.5%), and the rest (46.5%) were directly from the emergency department. When we categorized the patients' admission according to ACCM Guidelines, 39.4% of patients were in category I, 11.3% patients in category II, 36.6% in category III, 7% in category IV, and 5.6% in category V. When we compared the SOFA score along with the admissions category, there was no significant association. Mean ICU length of stay was 6.11 ± 4.99. There was no association found between the category of admission and the mean ICU length of stay. Overall, out of 355 patients, 255 patients (71.8%) transferred out, 20 patients (5.6%), and 80 patients (22.6%) could not be saved. In our study, 80.3% of transfers out were unplanned (this also includes the death of patients). There was a significant association between the admission category of patients and their outcome in the ICU.

Conclusion: The intensive care unit is an expensive setup. It is yet to be used in its maximum capacity for those who really need it. Triaging patients for the ICU is a must for better utilization of resources. Admissions and discharge policies should be followed stringently for optimum utilization of facilities.

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Introduction

Intensive care units are planned for quite sick patients who require close monitoring. There is a huge gap between demand and resources, especially in developing countries. Various societies made the guidelines for admission, but how these guidelines were followed was never assessed. The most common indication of intensive care unit (ICU) admissions is hemodynamic instability in patients. These criteria did not observe the baseline status of the patient. Making strict admission criteria and discharge policies is not feasible at times. It depends upon various patient-related variables such as age, vitals, chronic illness, and reason of acute decompensation, various treating physician-related factors such as nonavailability of trained doctors and nurses in the ward, and at times, it is only social pressure to keep the patient in the intensive care unit. So, on one hand, ICU staff got tired from patients with acute-on-chronic terminal illness, on the other hand, patients with reversible illnesses did not get the ICU support and we lost them. At our center, we used to refuse 2–3 admissions per day from emergencies who require ICU care due to nonavailability of beds. At least 3–4 patients genuinely requiring ICU care got admit in ward with a high-risk consent. This made us puzzle and we thought of this audit to face the reality.

An intensive care unit is a nursing unit for critically ill cases who cannot be managed safely in other wards. Suitability of the cases for admission to ICU may be decided on the basis of five criteria—(1) criticality, (2) instability, (3) requirement of intensive monitoring, (4) requirement of intensive therapy, and (5) reversibility of disease condition.[1,2] According to American Critical Care Medicine (ACCM) guidelines, category I patients are those who are critically ill, instable, need intensive monitoring and/or intensive therapy, and reversibility of disease condition is expected, such as acute respiratory distress syndrome (ARDS), diabetic ketoacidosis, thyroid storm, sepsis, and septic shock. Category II is similar to category I except their vitals are stable, such as upper GI bleed, seizure, etc. Category III patients are critically ill, unstable vitals, but the basic pathophysiology is not reversible, such as pericardial tamponade in a metastatic lung patient. Category IV includes patients who are seriously ill, with stable vitals, such as stable DKA, heart failure, and drug overdosage, and category V includes patients who are terminally ill, suffering from a disease whose reversibility is not possible.

Advice by the treating physician for admission to the ICU should be subject to approval by the in-charge of the ICU. While

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admitting the patient to the ICU, the presence of a coexisting infectious condition, if any, should be recorded. If the ICU does not have any isolation cubicles (with separate ventilation), there should be a policy decision about admission of critical cases requiring segregation. If these cases are to be admitted to the ICU, arrangement has to be made for treating them in separate cubicles because they cannot be kept along with other cases.[3] If the arrangement is not possible, these cases should be referred to other hospitals. About 10% beds (minimum one) may be kept vacant\readily available (patient earmarked for transfer out) to accommodate fresh emergencies.[4]

In view of pressure for ICU beds, the cases in the ICU must be kept for only as long as it is unsafe for the patient to be transferred out. The condition of cases, therefore, should be reviewed by the treating physician and the HOD, ICU, on a regular basis, every day. The head of the department of the ICU must ensure that admissions to the ICU are only as per the handling capacity of the staff available, because any harm to any patient due to a shortage of trained staff would be considered as a deficiency of service. Under no circumstances a patient should be admitted to the ICU without prior confirmation and readiness of bed and staff. While admitting a patient who may require ventilatory support, the availability of a ventilator must be confirmed from the ICU.

Transfer Out

It should be ensured that the disease process or the critical unstable physiological condition for which the patient was admitted has been reversed, and the patient no longer requires intensive monitoring or therapy. Some of the criteria for discharge/transfer to ward are as follows: the patient should be vitally stable, not on any vasopressor support, have normal spontaneous respiration with minimal oxygen requirement, and be neurologically stable.[5]

In our existing infrastructure, the two most common reasons for transfer out are that the patient in ward becomes sicker than the patient in ICU (So, we exchange patients), and the recovery of the patient from his illness. The third major problem is the cost of ICU care—many times, this also becomes important for patient care in developing countries where health insurance is not universal. So, we decided to check how many transfers out are planned. Recovery or getting well has a few components, such as stabilization of vitals, improvement in laboratory parameters, clinical improvement in symptoms and signs, devoid of any complications, and the patient is able to do their daily activity in the hospitals. A few illnesses left the patient crippled with some functional disability (temporary/permanent), such as cerebrovascular accidents, meningitis, peritonitis, and chronic kidney disease.

Materials and Methods

It was a descriptive retrospective study involving medical record-based data collection for a period of 6 months. A total of 355 patient records were checked, and appropriate statistical analysis was done using SPSS. Ethical clearance was taken from the Institute's ethical committee (AIIMS/Pat/IEC/2022/867).

Results

On analysis, most of the patients transferred into ICU were from ward rather than direct emergency (53.6 vs 46.5%), of these 54.9% patients were males.

The mean age of patients was 54 ± 17.43 (range 16–82), and the average length of stay was 6.11 ± 4.97.

While analyzing admission on the basis of recommended categories, we show that only 39.4% patients had category I indication, the rest altogether form 59.6%. These 59.6% patients actually needed a high dependency unit (HDU)/intermediate level ICU or palliative care ward facility (Table 1).

Analysis of variance (ANOVA) was done to test for the association of sequential organ failure assessment (SOFA) score with the priority level of the patients. There was a statistically significant association, as shown by $F(df) = 12.175(4)$, $p < 0.001$ (Table 2). The admission category of patients accounts for 12.5% of the variance (adjusted variance 11.5%) in the SOFA score. Bonferroni's *post-hoc* test showed that patients of category I (6 ± 2.1), II (6.5 ± 2.58), and V (6.75 ± 2.75) had more SOFA score than patients of category III (4.92 ± 1.62) and IV (4 ± 2.04). But the SOFA score of categories I and V is not significantly different.

While classifying discharges as unplanned and planned, we found that 80.3% i.e., 285 patients, were transferred out unplanned (death, LAMA, and with some life support such as vasopressor/high oxygen). Out of all discharges, 255 (76.18%) were transferred out to the ward, 20 (5.6%) were LAMA, and 80 (22.5%) were deaths.

There was a significant association between the priority level of patients and their planning of discharge from the ICU (Table 3). Pearson's Chi-square (X^2) test showed a value of 57.561, *df* 4, and *p* value of <0.001. In all categories of admission, the majority of the patients had unplanned discharge from the ICU, except in category IV patients (40%). About 89.3% of priority level I patients had unplanned discharge, whereas 100% of category II and V patients had unplanned discharge from the ICU. Among the patients who had planned discharge from the ICU, the category IV patients (60%) were significantly more than patients of other priority levels.

There was a significant association between the priority level of patients and their outcome in the ICU (Table 4). Pearson's X^2 test showed a value of 100.2, *df* 8, and *p*-value of <0.001. In all the priority levels, the majority of the patients have been discharged from the ICU, the highest proportion being in category I (85.7%). Death has occurred significantly higher among category IV patients (60%) and category V patients (50%). Among the patients who underwent LAMA, the category II (25%) and category V (25%) patients were significantly more than patients of other categories.

Kruskal–Wallis test was done to test to compare the length of ICU stay across the admission categories of the patients, since the data was not normally distributed (Table 5). There was a statistically significant association, as shown by X^2 (*df*) = 23.623 (4),

Table 1: Distribution of patients based on priority level of ICU admission (*n* = 355)

	Frequency	*Percent (95% CI)*
Category I	140	39.4 (34.6–44.5)
Category II	40	11.3 (8.2–14.6)
Category III	130	36.6 (31.5–42.3)
Category IV	25	7.0 (4.8–10.2)
Category V	20	5.6 (3.6–8.2)

Table 2: Association of SOFA score across different admission categories of patients (*n* = 345)

Admission category	*SOFA score*		*F (df)*	*p-value*
	Mean	*SD*		
I	6.00	2.10	12.175 (4)	<0.001
II	6.50	2.58		
III	4.92	1.62		
IV	4.00	2.04		
V	6.75	2.75		

Table 3: Association between admission category and planning of discharge of patient from ICU ($n = 355$)

Admission category	Planning of discharge		X^2 (df)	p-value
	Unplanned	Planned		
I	125 (89.3)	15 (10.7)	57.561 (4)	<0.001
II	40 (100.0)	0 (0.0)		
III	90 (69.2)	40 (30.8)		
IV	10 (40.0)	15 (60.0)		
V	20 (100.0)	0 (0.0)		

Table 4: Association between priority level of patient and outcome in ICU ($n = 355$)

Priority level	Outcome of patient [n (%)]			X^2 (df)	p-value
	Discharge	LAMA	Death		
I	120 (85.7)	0 (0.0)	20 (14.3)	100.2 (8)	<0.001
II	30 (75.0)	10 (25.0)	0 (0.0)		
III	90 (69.2)	5 (3.8)	35 (26.9)		
IV	10 (40.0)	0 (0.0)	15 (60.0)		
V	5 (25.0)	5 (25.0)	10 (50.0)		

Table 5: Association of length of ICU stay across priority levels of patients ($n = 355$)

Admission category	Length of ICU stay (days)		X^2 (df)	p-value
	Median ± IQR	Mean rank		
I	4 ± 6	161.66	23.623 (4)	<0.001
II	3 ± 6	138.94		
III	5.5 ± 6	190.02		
IV	6 ± 5	243.50		
V	7 ± 10	210.50		

$p < 0.001$. Length of ICU stay was significantly more among category IV and V patients than category I and category II patients.

Discussion

We searched Google, PubMed with MeSH terms "ICU admission criteria," "audit" and discharge policies, we found three audits done in England, Malawi and Nepal. These audits were done to know the outcome of the ICUs. These all audits were retrospective studies, and the duration was 1 year in each. The primary goals of doing these audits were to look into the outcome of the ICU, and not to compare with the standard criteria of admission and discharge. In this way, ours audit was different and showed the real time validation of ACCM guidelines to our health care system.

Although these guidelines were standard of care for united states of America, and to validate it in our clinical scenario is difficult. The above three are more like a clinical audit, this study was a quality improvement exercise. The other difference was that all these studies were done in a general ICU, while the present study done in medicine ICU. So, in our study postoperative patients and surgical patients were not included.

There was a male preponderance in our study similar to all other previous studies. Mean age of patients admitted was 54.75 ± 17.53 (range 16–82).

When we look for the area from where we received the patients, most patients were transferred in from the ward (53.5%), and the rest (46.5%) directly from the emergency department. The reasons for this could be nonavailability of beds in ICU at the time of admission, and sick patients requiring ICU being shifted to the ward, deterioration in patient condition in the ward due to more workload, and patients developed new complications due to lack of proper care. Many times, these patients were shifted to ICU in exchange with someone who was more stable but still requiring ICU care. So, this was a reason for an increased number of transferred out patients, which was unplanned (80%). These unplanned transfers out also included the deaths (all of which were taken as unplanned).

When we categorized the patients' admission according to ACCM guidelines, 39.4% patients were in category I, 11.3% patients in category II, 36.6% in category III, 7% in category IV, and 5.6% in category V. This showed that large part of admissions in the ICU is not justified. Around 60% of patients (categories II to V) could have been managed in the HDU/step-down ICU/palliative ward. This was a grave situation, as on one hand, terminally ill patients consume high-end resources, on the other hand, we refused patients who needed ICU care from the emergency room (although we did not have this data accurately). Admissions in the ICU are done by senior residents; their caliber to judge or doing triage may be a little different from senior physicians. To make this uniform, we encourage teaching and training of residents working in the emergency room. Triaging patients is important in resource-constrained countries. Chronic conditions make the patient vulnerable to multiorgan dysfunction, increasing morbidity and mortality. The number of organs affected is related to poor prognosis as seen in various ICU prognostication scores such as the SOFA score, Acute Physiological, Age, and Chronic Health Evaluation (APACHE) II score, and Modified Early Warning Score (MEWS).[6–8] It does not mean that we shall not try to reverse the acute insult to a chronically affected patient, but this emphasis on the concept of golden hour, so that we can minimize the ill effect of one organ on the other, which are not yet compromised.[9,10] That is the reason that tertiary care facilities should have an HDU/step-down ICU for close monitoring of such patients.

Mean SOFA score at admission was 5.55 ± 2.18. When we compared the SOFA score along with the admission categories, there was no significant difference between categories I and V. This nonsignificant association can be explained by the presence of many comorbidities in chronically ill patients and multiorgan involvement in those who are acutely compromised.[11] This is the limitation of the SOFA score. It is applicable to patients who are suspected of having sepsis.

The mean ICU length of stay was 6.11 ± 4.99, and the mean total length of stay of patients admitted in the ICU was 10.74 ± 9.84 days. There was no association found between different categories of admission and the mean ICU length of stay. The more the organ is affected, more time will take to stabilize it. Chronic illness of one organ affects the recovery of another organ from any acute insult. Common reasons for long stay in intensive care units are the need for mechanical ventilation, renal replacement therapy, hypomagnesemia, and sepsis.[12–14]

Discharging or transferring outpatients from the ICU is a challenge. Patient should be vitally stable, not requiring any respiratory/vasopressor support.[15,16] An intensivist should have a proper arrangement in the ward for

continuation of care.[17] Many times, it is good to step down them gradually, then shift to the ward. But such a facility is not present here in our setup.[18,19] Overall, out of 355 patients, 255 patients (71.8%) transferred out, 20 patients (5.6%), and 80 patients (22.6%) could not be saved. Planning for discharge/transfer out is very important because early transfer out can increase the number of readmissions in the ICU. In our study, 80.3% of transfers out were unplanned (this also includes the death of patients). The reason behind this large number of unplanned transfers out was a large backlog in the ward and ER for ICU beds, pressure from administration to provide beds for someone needy and waiting, more sicker patients in the ward getting unstable acutely, and financial burden on the family. Planning of transfer out when compared in all admission categories, it showed that most of the transfer outs were unplanned, especially in category V, where 100% of them were transferred out in an unplanned way (including transfer out to ward, LAMA, and deaths). There was a significant association between the admission categories of patients and their outcomes in the ICU. Pearson's X^2 test showed a value of 57.561, *df* 4, and *p*-value of <0.001. About 85.7% of the category I patients were discharged, while in category V, only 25%. Timely action for the appropriate patients leads to a good outcome—that's what the concept of golden hour proves.

Conclusion

An intensive care unit is a costly setup. It is yet to be used in its maximum capacity for those who really need it. Triaging patients for the intensive care unit is a must for better utilization of resources. Admissions and discharge policies should be followed stringently for optimum utilization of facilities.

Recommendations

- Triaging must be there when we work in a constrained facility.
- Clear admissions criteria to be followed. Early warning signs to be picked up by doctors to intervene in the golden hour.
- Step down/HDU/palliative ward will be an asset if we are providing an intensive care facility.

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