Research Article

Outcome of Patients Admitted to Intensive Care Unit in a Quaternary Care hospital

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Abstract

Background: Quality Improvement (QI) in intensive care unit (ICU) is directly dependent upon the outcome of patients treated in ICU. Poor quality of care not only increases morbidity and mortality but also increase expenses.

Objective: To conduct an audit on patients admitted to our ICU to determine their outcomes in terms of mortality and length of stay.

Methods: In this retrospective study, 330 patients who had been admitted to our intensive care unit (ICU) between December 1, 2022, and April 30, 2023, were reviewed. Patient's demographic data was collected, and correlation was done between the length of stay in ICU, APACHE II score and mortality using t-test.

Results: Out of 330, there were 209 males (63.3%) and 121(36.7%) females, with mean age of 41.9±15.3 years. There were 63 medical patients (19.1%) and 267(80.9%) surgical patients, mainly liver and kidney transplant patients. Mean duration of ICU stay for survivors was 3.1±3.3 days vs 6.9±7.7 days for non-survivors (p-value 0.003) and overall mortality rate was 12.7%, mostly with end-stage liver or kidney diseases. In medical patients, the APACHE II score for survivors was 17.9±7.8 versus 24.5±9.6 in non-survivors (p-value 0.007), and for deceased medical patients it was 24.4±9.6 on admission and 31.8±8.9 after 48 hours of admission (p-value 0.001). While APACHE II score among deceased surgical patients was 19.5±3.7 on admission and 25.7±5.8 after 48 hours of admission (p-value 0.015). Most common cause of death was sepsis and multi-organ failure.

Conclusion: This audit presents the profile of patients admitted in ICU of a quaternary level hospital of Pakistan, mainly catering advanced liver and kidney diseases including transplant. The commonest cause of death was septic shock and multi-organ failure. Higher APACHE II scores and longer ICU stay are the predictors of mortality among our patients.

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Introduction

Critically ill patients carry high mortality rates and their prolonged duration of stay in the intensive care unit (ICU) may also have a significant impact on both outcome and resources.[1,2] By reducing mortality, intensive care units (ICU) were designed with the primary objective of saving lives of critically ill patients. An essential component of ICU management is quality improvement (QI) and monitoring which is directly dependent upon the outcome of patients as poor quality of care not only increases morbidity and mortality but

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also increases healthcare expenses.[3] Therefore, increasing adherence to evidence-based medicine, monitoring and measuring outcome of patients ensure quality care.

Recent emphasis is on 'patient-centered approach' which helps not only in achieving good outcome of patient by decreasing mortality and improving quality of life leading to patient's satisfaction from care provided but also provides better service through proper allocation of resources, thereby decreasing the cost of care.[4] In this retrospective study we tried to assess the quality of care provided in our closed ICU model under qualified intensivist in terms of length of stay and mortality.

Methods

This retrospective study analysed 330 patients who were admitted to intensive care unit (ICU) of Pakistan Kidney and Liver Institute and Research Centre (PKLI-RC), Lahore between December 1st, 2022, and April 30st 2023. The data was obtained by reviewing electronic medical records of patients.

Criteria for recruitment was: Adult patients admitted to medical and surgical ICU requiring monitoring, Life-threatening illness requiring ICU admission, Surgical patients requiring ICU admission post-operatively for monitoring, Only pediatric patients with age less than 15 years were excluded from the study.

The variables studied were age, gender, diagnosis, reason for admission, duration of ICU stay, and outcome (survivor vs non-survivor). APACHE II (Acute Physiology and Chronic Health Evaluation II) scores were recorded in all medical patients admitted for critical illness management and in high-risk surgical patients rather than all given that most of the surgeries were electives requiring a very brief stay in ICU for observation and applying APACHE II on those stable surgical patients might have caused biased results.

Continuous variables are described as mean with standard deviation (SD) while categorical variables are described with frequencies and percentages. The student t-test was employed for quantitative variables, and a p-value of less than 0.05 was considered statistically significant. Statistical analysis was performed with SPSS 20 software (IBM).

Ethical approval was obtained from the IRB committee of the PKLI hospital (PKLI-IRB/AP/136).

Results

As shown in Table-1 out of 330 patients there were 209 males (63.3%) and 121 (36.7%) females and mean age was 41.9±15.3 years. Most of our patients are from outside Lahore (72.1%), as we get referrals from all over Pakistan, including patients from various socio-economic backgrounds, ethnicities, and languages demonstrating the diversity of the patient population. 63 patients (19.1%) were medical admissions while 267 (80.9%) were surgical patients. Mean length of ICU stay was 3.6±4.3 days, while for survivors it was 3.1±3.3 days vs 6.9±7.7 days in non-survivors (p-value 0.003). The overall mortality rate was 12.7%, with septic shock being the most common cause of death (66.7%).

Table 1: *Demographics of patients admitted to ICU.*

Variables	Results
Mean Age of Patients (Years)	41.9 ± 15.3
Mean Length of ICU stay (Days)	3.6 ± 4.3
Gender	Male: 209 (63.3%) Females: 121 (36.7%)
Residence	In Lahore: 92 (27.9%) Outside city: 238 (72.1%)
Outcome	Survived: 288 (87.3%) [M= 181; F=107} Expired: 42 (12.7%) {M = 28; F=14}
Total Mortality	42 (12.7%)
Medical patients	34 (53.9%)
Surgical patients	8 (2.9%)
Cause of death	
• septic shock	28 (66.7%)
• Multi-organ failure	7 (16.7%)
• Other causes of death	7 (16.7%)
Underlying diseases in expired patients	
• DCLD	28 (66.7%)
• ESRD	11 (26.2%)
• Other Causes	3 (7.1%)

DCLD: Decompensated chronic liver disease.
ESRD: End stage renal disease

In Table 2 diagnosis, patient's age, duration of ICU stay, and outcome are shown. Mortality among surgical patients was quite low at 2.9% (8 patients out of 267 surgical patients). Out of 41 living donor liver transplants(LDLT) recipients only 4 (9.8%) passed away while one out of 31 renal transplant (3.03%) died.

Two deaths following Whipple procedure and one following a central hepatectomy were among the other mortalities. All these 8 patients died from septic shock.

Among 63 medical admissions the commonest indication for admission was septic shock (50.8%), followed by multi-organ failure (17.5%), upper GI bleed secondary to decompensated liver disease (11.1%), hepatic encephalopathy secondary to decompensated liver disease (7.9%), acute on chronic renal failure (6.3%), while remaining (6.4%) included acute liver failure (ALF), acute respiratory distress syndrome (ARDS), pulmonary embolism and acute myocardial infarction with cardiogenic shock. None of our patient had line (central or arterial line) related sepsis nor had ventilator-associated pneumonia (VAP) as we strictly follow the Centers for Disease Control (CDC) guidelines.

The mortality among medical patients was 53.9% (34 patients out of 63 medical admits died) mostly from septic shock (20 patients out of 34 deaths; 58.8%) and multi-organ failure (20.6%; 7 out of 34 patients) followed by decompensated liver disease causing hepatic encephalopathy or upper gastrointestinal bleed, acute on chronic renal failure, and acute myocardial infarction with cardiogenic shock.

Table 2: *Diagnosis in relation to length of ICU stay and outcome:*

Diagnosis	N (%)	Gender	Age	Length of ICU Stay in days	Outcome (%)
Liver recipient	41 (12.4%)	M = 35 F = 6	49.8± 10.8	6.9 ± 7.2	A = 37 E = 4
Liver Donor	41 (12.4%)	M = 20 F = 21	26.9 ± 7.9	2.6 ± 1.5	A = 41 E = 0
Kidney Recipient	33 (10%)	M = 27 F = 6	34.9 ± 8.7	2.4 ± 0.9	A = 32 E = 1
Kidney Donor	33 (10%)	M = 15 F = 18	37.6 ± 10.7	1.2 ± 0.4	A = 33 E =0
Other Surgeries	119 (36.1%)	M = 72 F = 47	46.8 ± 16.1	3.1 ± 3.7	A=116 E = 3
Medical admissions	63 (19.1%)	M = 40 FF = 23	43.2 ± 16.2	5.02 ± 4.5	A = 29 E = 34

M = Male; F = Female; A = Alive; E = Expired.

The outcome of patients was compared using of age, duration of ICU, and APACHE II score in terms of survivors and non-survivors (Table 3). Mean age of patients was 41.2±15.2 in survivors vs 46.9±14.5 who died (p-value <0.022). But in sub-group analysis medical patients did not show statistical difference in age (P-value 0.264) vs surgical patients (p-value 0.003). Same

Table 3: *Outcome of patients.*

VARIABLES	Mean ± Std	p-value
Total Patients (n = 330)		
Age		
• Survived (n = 288)	41.2 ± 15.2	0.022
• Expired (n = 42)	46.9 ± 14.5	
Duration of ICU stay		
• Survivors	3.1 ± 3.3	0.003
• Non-survivors	6.9 ± 7.7	
Overall Mortality (n = 42; 12.7%)		
• Medical patients (n = 63)	E = 34 (54%)	< 0.001
• Surgical patients (n = 267)	E = 8 (3%)	
APACHE II score of Expired on Admission (n = 42)		
• Survived	23.4 ± 8.9	<0.001
• Expired	30.5 ± 8.7	
Medical Patients (n = 63)		
Age (in years)		
• Survived	40.7 ± 16.9	0.264
• Expired	24.5 ± 15.3	
Duration of ICU stay (in days)		
• Survivors	5.1 ± 4.1	0.842
• Non-survivors	4.9 ± 4.8	
APACHE II score on Admission		
• Survived	17.9 ± 7.8	0.007
• Expired	24.4 ± 9.6	
APACHE II score - Maximum		
• Survived	21.7 ± 10.9	<0.001
• Expired	31.8 ± 8.9	
APACHE II score of Expired patients		0.0001
• on Admission	24.4 ± 9.6	
• maximum score after 48 hours	31.8 ± 8.9	
Surgical Patients (n = 267)		
Age (in years)		
• Survived	41.2 ± 15.1	0.003
• Expired	53.5 ± 8.2	
Duration of ICU stay (in days)		
• Survivors	2.9 ± 3.1	0.017
• Non-survivors Expired	15.5 ± 11.5	
APACHE II score of Expired patients		
• on Admission	19.5 ± 3.7	0.015
• maximum score after 48 hours	25.7 ± 5.8	

trend is shown in duration of ICU stay where although overall patients showed significant difference in duration of stay among survivors and non-survivors (p-value 0.003); the medical patients ICU stay was not significant in terms of survival (p-value 0.842) vs surgical patients (p-value 0.017)

Mean admission APACHE II score for 63 medical patients was 21.23±9.32. On comparing ICU admission APACHE II score between survivors and non-survivors in medical patients we found APACHE II score for survivors was 17.9 ± 7.8 versus 24.4 ± 9.6 in non-survivors (p-value: 0.007) while APACHE II score after 48 hours was 21.7 ± 10.9 and 31.8 ± 8.9 in survivors and non-survivors, respectively (p-value <0.001). Thus, there was a rise in APACHE II score from 24.4 ± 9.6 to 31.8 ± 8.9 (p-value 0.0001) among patients who died. This trend is also seen in non-survivors from surgical group with rise of APACHE II score from 19.5 ± 3.7 to 25.7 ± 5.8 (p-value 0.015). Similarly, among patients who died from both medical and surgical causes, comparing the APACHE II score at the time of ICU admission vs 48 hours later. (Fig 1)

We found the rise of APACHE II score from 23.4 ± 8.9 to 30.5 ± 8.7 (p-value <0.001; Mean difference was 7 [95% CI 4,9]).

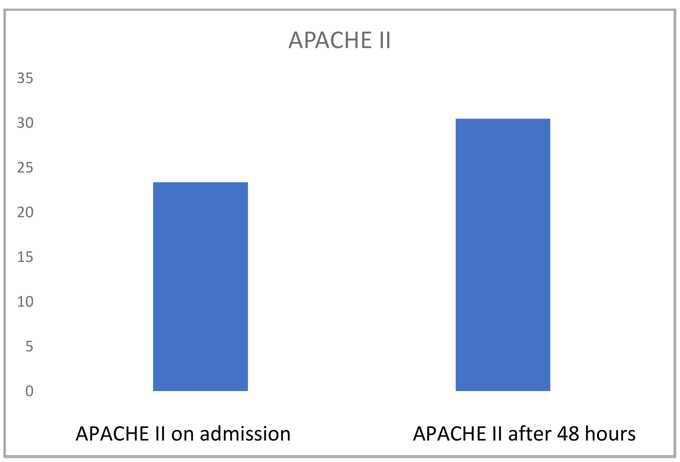

Figure 1: *Mean APACHE II score on admission (23.4 ± 8.9) to ICU and after 48 hours (30.5 ± 8.7) in deceased patients.*

Discussion

This study is evaluating quality of care provided to our ICU patients using duration of ICU stay and outcome in terms of survival. Patient-important outcomes had two components: death at any point in time and quality of life expressed in terms of functional, cognitive, and neurological outcomes measured following discharge from the intensive care unit.[4,5,6] The duration of stay is directly linked to the complications that develop during ICU stay, prolonging hospitalization including duration of mechanical ventilation, multi-organ failure, renal replacement therapy, ICU readmission, non-invasive ventilation, tracheostomy, transfusion, need for surgery, nosocomial pneumonia, catheter-related infections, delirium, venous thromboembolism, pain, critical care neuropathy, and ultimately reduce quality of life as regards functional, cognitive or neurological events.[4,7] All these impact on resources consumption both to patient and from hospital budget.

It was observed that patients with higher age and prolonged ICU stay had poor outcome as compared to the survivors group. In our study the duration of ICU stay for liver transplant (LT) patients was longer than other cases since these are more complex and high-risk patients with slow recovery during postoperative period and generally takes 6 to 8 days.[8]

Overall mortality in this study was 12.7% with majority being medical cases (53.9%) versus surgical cases (2.9%). Being the largest liver and kidney transplant hospital in the country, most of our admitted patients have end-stage liver and kidney diseases, that already have a significant morbidity and mortality rate. Critically ill patients commonly die from sepsis[9] and the main causes of short-term mortality especially in post liver transplant patients include infections and circulatory problems.[10] In our patients also the most common cause of death was septic shock (66.7%) and muti-organ failure (16.7%). Patients with sepsis have higher hospital mortality than non-septic patients, with ICU and hospital death rates of 25.8% and 35.3%, respectively.[11] Septic shock, which causes over 50% of deaths in intensive care units (ICUs) and accounts for 10% of admissions, affects 15% of patients with sepsis.[9,12] The mortality among our liver transplant patients was 9.8% which is comparable to international data as the short-term mortality rate following liver transplant is between 10% and 15% throughout the first 90 days after LT.[9] While the short-term mortality rate for patients undergoing kidney transplants is from 1.7% to 4.1% for kidney transplants,[13] while we had 3% mortality in renal transplant. These figures are comparable to international data.

We used the APACHE II score in our patients as it is a known predictor for the prognosis of critically unwell patients in ICU.[14] The higher sensitivity (89.9%) and specificity (97.6%) of the APACHE II score over other scoring systems, such as SOFA (90.1% sensitivity and 96.6% specificity) and mNUTRIC (97.2% sensitivity and 74.0% specificity),[15] was another factor advocating APACHE II as a more reliable indicator of death in patients with critical illnesses. In this study, APACHE II score for survivors was lower (17.9 ± 7.8) than for non-survivors (24.4 ± 9.6) with p-value of 0.007 among medical patients. Importantly, those patients whose APACHE II scores worsened during ICU stay also showed higher mortality rate both in medical and surgical patients (p-value < 0.001). This is consistent with previous studies reporting higher and worsening of APACHE II score as a predictor of mortality.[16] In order words, a lower APACHE II score favors a higher likelihood of survival. According to Tian et al., patients who have an APACHE II score of 17 or above on the third day of their ICU stay are at a significant risk of dying.[17]

Patients who are admitted to an intensive care unit (ICU) have a greater mortality rate; nevertheless, neither a basic outcome nor a taxonomy of outcomes have been developed for critically ill patients. This may result in discrepancies in the reports and make it difficult to compare the outcomes across studies and combine them into systematic reviews and meta-analyses. Important clinical outcomes for patients have been widely accepted in certain areas of research.[18,19] Therefore, besides mortality outcomes, we included length of ICU stay which clearly affects the resources and financial status of patient. We found that in a closed ICU model under dedicated and qualified intensivist, the mortality can be controlled matching international standard even when providing care to very high-risk and complex patient population. Therefore, as other studies have shown a well-equipped and staffed by intensivists, intensive care can lower mortality rates by 15–60%.[20]

There are limitations to our study. First, this was a single centre study in a specialized center, therefore generalizability of the results to other settings may not be appro-priate. Secondly, we do not have follow-up patients after discharge from hospital (especially non-surgical patients) to assess their quality of life post critical illness recovery. Thirdly, as our surgical patient population consisted mostly of elective surgeries, including liver and kidney transplants, besides some urological and hepatobiliary surgeries, we didn't collect APACHE II (Acute Physiology and Chronic Health Evaluation II) scores on all surgical patients except for those who died.

Conclusion:

The study shows that longer ICU stay, and high APACHE II scores are associated with higher mortality. A rising APACHE II score warns clinicians of the likelihood of impending mortality and encourages them to modify their treatment strategy. It can therefore be considered a valuable tool for clinically predicting ICU mortality. We advocate closed-ICU model under qualified intensivist in such high equity centers.

Ethical Approval: The Institutional Review Board of Pakistan Kidney and Liver Institute and Research Center approved this study vide Reference No. PKLI-IRB/AP/136.

Conflict of Interest: The authors declare no conflict of interest.

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Authors' Contribution:

SS: Conception and design, acquisition of data, drafting and revising article, final approval of the version

AS: Acquisition of data, analysis and interpretation

AI: Acquisition of data, analysis and interpretation

WAR: Analysis and interpretation

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