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Clinical Outcome of Patients Admitted to Critical Care Unit in Karnali Province

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ABSTRACT

Background: Life-threatening illnesses are rising globally, disproportionately affecting patients from developing countries. The outcome of such illness depends on the critical care services provided to the patients. Constrained resources may impact the quality and outcome of critical care. This study aims to assess the outcomes of critically ill patients admitted to the Intensive Care Unit (ICU) of a hospital in remote Karnali Province of Nepal

Methods: This retrospective observational study reviewed data of ICU patients admitted from July 2021 to July 2022 in Province Hospital, Karnali, Nepal. Analysis included data on socio-demographic information, clinical diagnosis, duration of stay in ICU, use of mechanical ventilator, and outcomes of patient admitted to the ICU.

Results: A total of 745 patients were admitted within the specified time period. The most common diagnoses were chronic obstructive pulmonary disease (COPD), poisoning, and acute coronary syndrome(ACS). Non-communicable diseases accounted for 60% of admissions. Overall, 17% of patients received support via mechanical ventilation. 50% of patients admitted in the ICU were recovered. The ICU mortality rate was 22 %, whereas 23% left the ICU against the medical advice. Age ($p<0.001$), ventilator use ($p<0.001$), and source of admission($p<0.001$) were significantly associated with death in the ICU. Though the mortality rate varied significantly across diagnoses, septic shock and COPD attributed to the highest mortality.

Conclusions: Non-communicable diseases were the most common cause of admission to the ICU of the hospital. Half of the ICU patients had poor outcomes, with one out of four succumbing to death. Factors like suboptimal speciality services and equipments, poor infrastructure development, and poor human resources might have contributed to poor outcomes in such settings.

Keywords: Critical care; intensive care; mortality; prognosis; pulmonary disease chronic obstructive.

INTRODUCTION

The global burden of serious life-threatening illness has been growing, the total death due to serious health-related suffering being 26 million in 2016 which is expected to reach 87 %by 2060.[1] To prevent death from life-threatening illnesses, an intensive care unit (ICU) that provides intensive and specialized medical and nursing care is vital.[2] Globally, overall mortality rate in ICU admitted patients was 14%.[3] However, there is noticeable disparity in ICU patient outcomes among countries with more death rates reported in developing countries.[3-6]

Nepal, a low-income country, is witnessing a significant number of cases that need ICU care. A 2019 report on the Burden of Diseases revealed that the proportion of non-communicable diseases, communicable diseases, and injuries were 71%, 21%, and 8%, respectively.[7] Out of those diseases, cases that require ICU care were peritonitis, postoperative monitoring, organo-phosphorus poisoning, sepsis/ multi-organ dysfunction etc.[8] However, situation of ICU care in Nepal is critical. Data shows Nepal has 2.8 ICU beds per 100,000 population with only half of them equipped with mechanical ventilators.[9] Mortality of ICU patients ranges from 15.2 to 39.3% in central hospitals.[10,11] Recent multicenter evidence from Nepal, including a study conducted across 17 ICUs in two provinces, reported an overall ICU mortality rate of approximately 18%, with nearly 84% of patients showing

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clinical improvement and being transferred to their respective wards.[12] Hospital-based ICU studies from major academic centers in Nepal demonstrate variable mortality rates, ranging from 21% at Bir Hospital, Kathmandu, to 26% at B. P. Koirala Institute of Health Sciences (BPKIHS), Dharan, while substantially lower mortality (11.3%) has been reported from Dhulikhel Hospital, Kathmandu University Teaching Hospital.[13-15] Despite available data from tertiary centers, ICU outcome information from remote and less developed provinces of Nepal, particularly from community-based government hospitals, remains scarce.

To address this gap, we conducted a study analyzing outcomes of patients admitted to the ICU of Province Hospital, Karnali Province, Nepal, and identifying factors associated with all-cause ICU mortality. Findings from this study is also expected to offer insight into the impact of geographic and health system constraints on critical care outcomes.

METHODS

This was a retrospective observational study of critically ill patients admitted to a tertiary level hospital in Karnali Province. The government hospital was a referral center of 10 districts of Karnali Province located at Mid-Western region of Nepal. The hospital accepted the government-based insurance scheme if eligible, rest had to pay out-of-pocket at an affordable cost for the services they received. The hospital had specialized services in almost all specialties and had been running an ICU since 2017.The ICU had 12 beds and had been operating for 24 hours. The ICU beds represented 4.8 % of the total beds of the hospital and 50% of the ICU beds had access to mechanical ventilators. On duty doctor (one medical officer per shift) constantly monitored the ICU patients supported by specialists in internal medicine, anesthesia, and critical care. Corresponding specialists (e.g a neurosurgeon) were also available for the respective specialty services. Provided with a fewer number of specialists, they only performed daily rounds and were available on-call basis rather than on-regular duties. The hospital only had four consultant physicians and two consultants of anesthesia and critical care. The nurse-patient ratio varied depending upon the duty shift with an average of one nursing staff for three patients, a total of 31 nurses took care of 13 ICU beds in addition to other 11 neonatal and pedicatric ICU in rotation. The ICU had a portable X-ray machine, a portable ultrasound with an echocardiography probe, and an ABG machine. Dialysis service was not available within the ICU, though the hospital had a separate hemodialysis unit with facility for six hemodialysis machines. The hospital did not have a cardiac catheterization lab.

The study was approved by National Health Research Council (Reference No.1370, Protocol Registration No. 402/2022). We sought permission from hospital administration to extract data from the register and records of the hospital. Being a retrospective study based on secondary data, we could not get consent from individual patients. To ensure confidentiality, all hospital records were anonymized prior to data extraction, and no personal identifiers were accessed or recorded at any stage of the study.

This study included data from all ICU patients who were admitted over one year from 2021, July 16 and 2022, July 16 (2078/04/01 to 2079/03/32). The data was assessed for research purposes from 24 December 2022 to March 2023. The analysis included data from those patients aged 16 years or older. Patients with incomplete or missing diagnostic information were excluded from the analysis. In addition, individuals younger than 16 years were excluded, as some pediatric cases were admitted to the adult ICU during periods of limited pediatric ICU bed availability.

The hospital register and medical records were used to extract the data in an excel form. These data included age, sex, address (residential district of the patients), clinical diagnosis, admitting department (e.g. emergency, ward), duration of ICU stay, use of a mechanical ventilator, duration of stay in mechanical ventilator, the outcome of the patients. The outcome of the patient was operationalized as discharged, expired, referred to other centre, or left against medical advice (LAMA).

Before coding, data were cleaned by checking for completeness, removing ineligible patients (<16 years), excluding records with missing diagnostic information, resolving duplicate or inconsistent entries, and standardizing clinical diagnoses. Variables were then coded into categorical and continuous formats suitable for analysis. The coded data was then, exported to SPSS V.18.0 for further analysis. Descriptive statistics was used to identify the distribution of factors among socio-demographic characteristics. Chi-square test was conducted for comparing association of outcomes with categorical variables. All tests were two-tailed and $p < 0.05$ was considered statistically significant.

RESULTS

A total of 839 patients were admitted over a pre-specified one-year period. Out of the admitted patients, 745 met the inclusion criteria. Half of the patients were male (50.73 %).The age range of the included patients was from 17 to 92 years with a mean of 50.58 ±19.84 years. More than half (57%) of patients were aged 30 to 60 years. Most of the patients were from Surkhet(70.87%) and were admitted in the month of Asadh(11.41%, n= 85)Of the total admissions, 60% of patients were admitted between Falgun to Bhadra (Table 1)

Table 1. Sociodemographic characteristics of the included patients.

Variables	Category	Frequency(n)	Percentage (%)
Gender	Female	367	49.3
	Male	378	50.7
Age group(years)	<40	251	33.70%
	40-60	232	31.10%
	>60	262	35.20%
	Mean ± sd=50.58± 19.84 years		
Districts	Surkhet	528	70.90%
	Neighbouring district[a]	192	25.90%
	Upper hilly areas of X[b]	13	1.70%
Months	Baisakh	61	8.2
	Jestha	76	10.2
	Asar	85	11.4
	Shrawan	69	9.3
	Bhadra	64	8.6
	Asoj	45	6
	Kartik	49	6.6
	Mangsir	54	7.2
	Poush	52	7
	Magh	53	7.1
	Falgun	66	8.9
	Chaitra	71	9.5
Duration of Hospital stay(days)	≤5	630	84.6
	6-10	95	12.8
	>10	20	2.6%
	Mean ± sd =3.67± 4.12 days		
Duration of Ventilator stay(days)	<=5	110	14.8
	6-10	15	2.0
	11-15	1	0.1
	16-20	1	0.1
	>20	2	0.3
	Mean ± sd =3.46± 6.37 days		

[a]Neighbouring districts- Bardiya, Dailekh, Jajarkot, Salyan, Kalikot, Rukum, Kailali ;[b]upper hilly districts- Humla and Jumla, sd- standard deviation

Cause of ICU admission and service utilization in the ICU varied among included patients. Most of the patients were admitted from emergency department (78.39%). This was followed by admission from in-patient departments (14.90 %) and operation theatre (6.44%). Overall, the average length of stay in the ICU was 3.67±4.12 days. The range of

ICU admission was 1 day to 79 days. Majority of patients (84%) stayed in the ICU for less than 5 days. Seventeen percentage (n=129) of the patients treated under mechanical ventilation. The average length of stay in mechanical ventilation was 3.46 days± 6.37 days. Out of those who were under mechanical ventilation, 92% used ventilator for less than 5 days (Table 1 and table 2).

Table 2. Distribution of outcome of included ICU patients.

Outcome	Number	Percentage
Expired	163	21.9
Left against medical advise	135	18.1
Referred to other centre	32	4.3
Improved with subsequent transfer to wards	374	50.2

Results showed that the included patients were admitted with a range of diagnoses. Overall, 87% were medical cases and 13% were surgical cases. The most common admitted cases in ICU were chronic obstructive pulmonary diseases (COPD), accounting for 13.21%, followed by poisoning (11.32%), and acute coronary syndrome (ACS) (7.41%). Other commonly admitted cases were upper gastrointestinal bleeding, cerebrovascular accident (CVA), septic shock, and head injury. Of the total ICU cases, 62.66% were related to non-communicable diseases (NCD), 9.97% were of infectious origin, and 7.81% were trauma-related (Table 2) Table 3. The distribution of diagnosis, duration of stay, and mortality of the included patients.

Table 3. Distribution of outcome of included ICU patients.

Diagnosis	*Total cases = n (% of total cases)*	*Mean duration of ICU stay (days±S.D.)*	*Mortality= n(% of total mortality)*
COPD	98(13.21%)	2.79(±2.29)	25(25.51%)
Poisoning	84(11.32%)	3.22(±2.47)	15(17.86%)
ACS	55(7.41%)	4.14(±2.44)	8(14.55%)
UGI Bleeding	36(4.85%)	2.83(±1.71)	10(27.78%)
CVA	35(4.72%)	3.77(±2.08)	3(8.57%)
Septic shock	32(4.31%)	3.78(±2.97)	13(40.63%)
Head injury	31(4.18%)	5.83(±7.03)	8(25.81%)
CKD	30(4.04%)	3.73(±2.37)	7(23.33%)
Pneumonia	29(3.91%)	3.75(±3.69)	10(34.48%)
Obstetric	29(3.91%)	3.51(±2.50)	3(10.34%)
DKA	27(3.64%)	3.96(±2.06)	5(18.52%)
Sepsis	26(3.50%)	4.23(±2.50)	6(23.08%)
General surgery	23(3.10%)	3.47(±3.13)	8(34.78%)
CCF	16(2.16%)	3.06(±1.65)	4(25%)
Pancreatitis	16(2.16%)	5(±4.06)	1(6.25%)
Seizure disorder	14(1.89%)	3.64(±2.02)	1(7.14%)
Arrythmia	13(1.75%)	1.53(±0.66)	2(15.38%)
Cirrhosis	11(1.48%)	2.54(±1.80)	4(36.36%)
Orthopedics trauma	11(1.48%)	6.27(±4.92)	0(0%)
Snake bite	10(1.35%)	3.7(±2.21)	2(20%)

COPD (Chronic Obstructive Pulmonary Diseases), ACS (Acute Coronary Syndrome), CKD (Chronic Kidney Disease), CCF (Congestive Heart Failure),CVA (Cerebrovascular Accident), SD (Standard Deviation)

Proportion of poisoning cases were 11.32%, the second highest after COPD cases. Out of those cases, organophosphorus poisoning was most common cause of poisoning (34.52%, n=29) followed by unknown poisoning and zinc-phosphide poisoning (23.80% and 15.47%, respectively). Interestingly, 59% of total poisoning cases occurred in 17 to 36 years age group.

The male to female ratio was 1.54. Recovery rate among poisoning cases was 73.81% with a mortality of 17.86%.

The ICU had mixed outcomes. The data showed that 50% of patients admitted in the ICU were recovered. The total mortality rate of patients admitted to ICU was 22 %. However, we were uncertain about 23.26% of patients, who were left against medical advice. Out of all patients who left against medical advice, 42.22 %were in the age group 57 to 76 years. The mortality rate among the patients under mechanical support was 49.61 %. Out of patients under ventilation 24.81% were improved and transferred to the ward. (Table 1 and Table 2)

The mortality rate differed among the admitted patients. The highest mortality rate was seen in septic shock patients (40%) followed by surgical cases (34.78%). Data showed that one-fourth of ICU patients admitted for COPD could not be recovered. The mortality rate for the poisoning and ACS were 17.86 % and 14.55%, respectively. (Table 3)

Table 4.Distribution of diagnosis, duration of stay and outcomes of included patients in MV, mean duration of stay and outcomes.

DIAGNOSIS	*Total patients (n)*	*Mean duration of stay= Days (±S.D.)*	*Mortality=n (% of diagnosis)*	*Improved (% of the diagnosis)*	*LAMA=n (%of the diagnosis)*
Head injury	18	4.94(5.7)	7(38.89%)	3(16.67%)	6(33.33%)
COPD	13	2.31(1.8)	7(53.85%)	1(7.69%)	5(38.46%)
General surgery	11	1.81(1.4)	7(63.64%)	4(36.36%)	0(0.00%)
CVA	10	4(2)	2(20.00%)	2(20.00%)	6(60.00%)
Pneumonia	9	2.44(2)	5(55.56%)	1(11.11%)	2(22.22%)
Poisoning	9	1.78(1.3)	7(77.78%)	2(22.22%)	0(0.00%)
CKD	7	3(1.8)	3(42.86%)	2(28.57%)	2(28.57%)
Obstetric	5	3.2(2.3)	3(60.00%)	2(40.00%)	0(0.00%)
UGI bleeding	5	2(1.4)	3(60.00%)	1(20.00%)	1(20.00%)
Snake bite	4	4.5(3.4)	2(50.00%)	2(50.00%)	0(0.00%)

COPD (Chronic Obstructive Pulmonary Diseases), ACS (Acute Coronary Syndrome), CKD (Chronic Kidney Disease), CVA (Cerebrovascular Accident), LAMA (Left Against Medical Advice), SD (Standard Deviation)

There was a significant association between the outcome with age group (p<0.001), source of admission (p=0.001), and use of ventilator (p<0.001) (Table 5)

Table 5. Factors associated with overall outcomes of admission in the ICU.

Variables	Categories	Expired (n=163)	Recovered (n=374)	Not sure[a] (n=208)	p value
Age	<40	43 (26%)	146 (39.04%)	50 (24.04%)	
	40-60	63 (39%)	113 (30.21%)	68 (32.69%)	**<0.001**
	>60	57 (30%)	115 (30.70%)	90 (43.30%)	
Sex	F	74 (45%)	200 (53.48%)	93 (44.71%)	0.069
	M	89 (55%)	174 (46.52%)	115 (55.29%)	
Districts	Dailekh	30 (18%)	60 (16.04%)	29 (13.94%)	
	Others	1 (1%)	3 (0.80%)	1 (0.48%)	0.923
	Rural districts of Karnali	22 (13%)	45 (12.03%)	26 (12.50%)	
	Surkhet	110 (67%)	266 (71.12%)	152 (73.08%)	
Month	Asar-Bhadra (Jun/Jul-Aug/ Sep)	51 (31%)	107 (28.61%)	60 (28.85%)	

Table 5. Factors associated with overall outcomes of admission in the ICU.

Variables	Categories	Expired (n=163)	Recovered (n=374)	Not sure[a] (n=208)	p value
	Asoj-Kartik (Sep/Oct-Oct/Nov)	21 (13%)	44 (11.76%)	29 (13.94%)	
	Chaitra-Jest (March/Apr-May/Jun)	42 (26%)	110 (29.41%)	56 (26.92%)	0.963
	Mansir-falgun(Nov/Dec to Feb/Mar)	49 (30%)	113 (30.21%)	63 (30.29%)	
Medical_surgical	Medical	146 (90%)	342 (91.44%)	188 (90.38%)	0.772
	Surgical	17 (10%)	32 (8.56%)	20 (9.62%)	
NCD	Communicable diseases (CD)	42 (26%)	66 (17.65%)	43 (20.67%)	0.097
	NCD	121 (74%)	308 (82.35%)	165 (79.33%)	
Duration of stay	>10	4 (2%)	5 (1.34%)	11 (5.29%)	0.086
	≤5	139 (85%)	319 (85.29%)	172 (82.69%)	
	6 to 10	20 (12%)	50 (13.37%)	25 (12.02%)	
Admitted from	Emergency	119 (73%)	292 (78.07%)	173 (83.17%)	
	Outpatient	0 (0%)	1 (0.27%)	0 (0.00%)	
	OT	8 (5%)	36 (9.63%)	4 (1.92%)	**0.001**
	Post-op	1 (1%)	0 (0.00%)	0 (0.00%)	
	Ward	35 (21%)	45 (12.03%)	31 (14.90%)	
Ventilator use	No	99 (61%)	342 (91.44%)	175 (84.13%)	**<0.001**
	Yes	64 (39%)	32 (8.56%)	33 (15.87%)	

[a] includes discharged in request, leave against medical advice, and referred

DISCUSSION

The current study assessed the status and outcomes of the patients admitted in an ICU of a hospital in Karnali Province of Nepal. The current study showed that half of the patients admitted in the ICU of Province Hospital, Karnali were recovered and one-fifth of total died. The mortality rate reached 49% when patients were mechanically ventilated.

Data from the current study showed that the confirmed death in ICU was 22%. The current proportion of patients dying after receiving treatment in the hospital ICU was comparable to other similar studies. Results from studies in other developing nations show comparable mortality rates, 25 % in Uganda (Towey et al) and 24.32 % in Brazil (El-Phakhouri et al), and a slightly higher rate of 35.1 % in Nigeria (Abubakar et al).[16-21] However, the mortality rate in current study is more than the worldwide ICU mortality of 16.2%.[3]

Mortality rates from critical care units in Nepal have been reported to range from approximately 11% to 26%. A recent seven-year audit from TUTH-IOM documented a mortality of around 26%,[22] while a study from Palpa, a rural district hospital in Lumbini Province, reported a mortality rate of 21.9%.[23] The mortality observed in the present study from Karnali Province is comparable to these findings. Comparable mortality in regional and rural ICUs may reflect several contextual factors. Patients with the most severe illness may die before ICU admission because of delayed transfers and limited access to timely critical care in remote settings. In addition, ICU admission in rural hospitals is often more selective, with fewer admissions of patients unlikely to survive, resulting in a different case mix. Finally,

close, consultant-delivered care with greater continuity of clinical decision-making in smaller rural ICUs may contribute to favorable outcomes despite resource limitations.[24]

The most concerning result of our study is the leave against medical advice (LAMA), accounting for 23% of total admissions. In the study by Acharya et al, the LAMA rate was only 7.74% whereas the higher rate in this study might be the indicator of lower overall health and financial status of the people in Karnali Province.[8] The prevalence of the disease among elderly population,[25] and the neglect by the caregiver in the context of the high cost of treatment and poorer outcome of the disease may have been reflected in this finding. This shows that significant proportion of patients in the Karnali province who are admitted in the hospital are not capable of using the ICU service. Financial problems like high out of pocket expenditure in Nepali health system, indirect costs associated with hospital stay and loss of employment of caretaker are important contributing factors. The hospital does not provide the ICU service free of cost. Although ICU services are covered under the National Health Insurance Program, insurance coverage remains limited, with only about 17% of the population utilizing health services through the insurance system.[26] Consequently, for the majority of patients, out-of-pocket expenditure remains the primary means of financing ICU care. This financial burden may partly explain the higher proportion of patients leaving against medical advice (LAMA), particularly in rural settings. This finding is supported by the fact that LAMA rate was highest in the age group 57-76 years, where the expectancy of survival is poor. These findings suggest that affordable ICU service will only be possible when we implement strategies to reduce the out-of-pocket expenditure of the patients and their relatives. One solution will be expanding the health insurance policy to all.

This study found that half of ICU patient outcomes were unsatisfactory, influenced by multiple factors. Late hospital arrival due to poor transportation, delayed diagnosis from a shortage of trained professionals, and low health literacy contribute to poor outcomes. Additionally, ICU services are limited, with staffing shortages, a lack of critical care specialists, inadequate training for nurses, and insufficient equipment like mechanical ventilators. The hospital also struggles to perform major procedures, such as cardiac catheterization.

The current study found a significant association between age and mortality of included patients. The present study showed that the highest mortality rate was among patients in 71- 80 years age group, and similar findings of increasing mortality with increasing age is observed in related studies,[18,27]which might be explained by the age-related decline in physiological reserve and higher burden of comorbidities.

The current findings showed that non-communicable diseases (COPD followed by poisoning and ACS) accounted for more than half of the admission to the ICU. Current study results showed that the proportion of COPD patients was 13%, Data from the present study suggesting the need of a more effective ICU for COPD patients in rural area is even crucial highlighted by the fact that mortality rate was 25% and the rate of leaving against medical advice among COPD patients was 38%.

COPD accounted for 2.6% of ICU admissions in a multicentric ICU study[12]; in contrast, COPD constituted 13% of ICU admissions in our study. This higher proportion is consistent with the increased prevalence of COPD in Karnali Province and may be attributed to widespread use of fossil fuels and adverse socio-demographic factors, including smoking and low educational attainment.

The current study showed that one out of ten ICU-admitted patients succumbs to poisoning. The age group of patients exposed to poison was 17 to 38 years. These findings might reflect a serious mental health crisis, among adults and working age population in the Karnali Province of Nepal. The mental health crisis is attributable to multiple socioeconomic factors, with high poverty rates and young adult struggling to support their families without job. Other factors leading to higher poisoning cases could be family conflict, more availability of pesticides in the background of agriculture predominant economy, and social stigma associated with the diagnosis of mental health disorders.

Overall, the importance of robust ICU care has been highlighted by this study. A rising trend of NCDs and trauma cases in recent years signifies the importance of better ICUs in the future. Similarly, the higher trend of mortality and leave against medical advice suggests changing current health policies. These policy changes may include strengthening skilled health manpower, arranging health equipment, minimizing out-of-pocket expenditure, and reducing caregiver neglect. However, as a retrospective analysis, it has limitations, including missing data that may affect result accuracy. Additionally, reliance on recorded data prevented assessing factors like family economic status.

CONCLUSIONS

This study analyzed the data on the critical care services provided by an ICU of a tertiary care center of remote province of Nepal. The most common causes of ICU admission were non-communicable diseases including COPD, poisoning, and acute coronary syndrome. One out of two admitted cases was recovered, one-fifth of patients confirmed death and one out of four left the ICU against the medical advice. Our study highlights the urgent call for targeted interventions and policy reforms to enhance critical care delivery and mitigate the burden of life threatening illnesses in resource constrained settings.

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CONFLICT OF INTEREST

Authors declare there are no any conflicts of Interest.

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