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Original Research Article

Clinical Characteristics and Outcome of Patients Admitted in ICU of a Teaching Hospital: Prospective, Observational Study

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Conflict of interest: Nil

Abstract

Objective: To find demographic, clinical and epidemiological characteristics, comorbidities, outcome and mortality in ICU.

Methods: We did a prospective observational study of medical records of critically ill patients admitted to intensive care unit (ICU). The data on demographic, clinical and epidemiological characterstics treatment received and outcomes of patients admitted in ICU was analysed. SOFA score at admission, then at 24 hours and then at 48 hours was done. ARDS was accessed by Berlin criteria. KDIGO Criteria for AKI and diagnostic stratergies for VAP was used for assessment, prognosis and improvement after treatment.

Results: By multivariate analysis, predictors of in-hospital mortality were Sepsis-related Organ Failure Assessment (SOFA) score at ICU admission, SOFA score over the first 3 days in the ICU. In our ICU patients are refered from medicine and emergency department (78 %) followed by accident and trauma (18%). Patients of medicine department were of old age and had accompanying comorbidities. Patients with high SOFA score, old age, comorbidities, long ICU stay, and those who needed invasive ventilation had higher morbidity and mortality.

Conclusion: Both outcome and mortality were favourable in patients with low sofa score. Mortality was more in patients with comorbidities. We want to be able to understand the characteristic features of patient admitted in ICU and factors associated with the increased mortality. This data can be used in making stratergies and future actions for the betterment of patients and improvement of services of the ICU.

Keywords: Sepsis-related Organ Failure Assessment (SOFA) score, acute respiratory distress syndrome (ARDS), Berlin Criteria, Kdigo Criteria, Acute Kidney Damage (AKI), Ventilator Associated Pnemonia (VAP), ABCDE bundle (Awakening and Breathing Coordination of daily sedation and ventilator removal trials; Choice of sedative or analgesic exposure; Delirium monitoring and management; and Early mobility and Exercise)

Introduction

Intensive care unit (ICU) is a unit in any hospital where critically ill patients are managed. History of ICU goes back almost 60 years ago when first ICU was setup in Europe for polio epidemic. Since then the concept of critical care has evolved. Demographic, clinical and epidemiological data of patients admitted in ICU is a important information. In ICU's mortality rates are higher than other services. [1,2]

This study is aimed to collect the same data at a tertiary care centre of Bhopal. With help of this study we will be able to understand the characteristic features of patient admitted in ICU and factors associated with the increased mortality. This data can be used in making stratergies and future actions for the betterment of patients and improvement of services of the ICU.

Materials and Methods

We conducted a prospective and observational study at Department of Anesthesia, L.N. Medical College and J.K. Hospital Bhopal. After getting approval from RAC and IEC we conducted our study at ICU complex. Patients who fulfilled inclusion criteria and gave informed consent were included in the study. A data collection form was filled by investigators. The information collected from these forms was analyzed and used to prepare our result. Clinical Characteristics like Age, Sex, Co Morbidities, Baseline (Sequential organ failure score) SOFA Score, requirement of Ventilator support, Blood transfusion, Renal Replacement and admission ABG were recorded. Outcome was recorded in term of 28 Days Mortality.

Study Design-Prospective Observational study

Sample Size – 500 (On basis of approx admissions in ICU)

Study duration – Twelve month.

Inclusion criteria:

Patient admitted in ICU complex during study period.

Age group 14 years and above

Exclusion criteria

Refusal of Consent **Consent:** Written consent was obtained from the relatives of patients after explaining them the nature and purpose of the study. They were assured that confidentiality would be strictly maintained. The option to withdraw from the study was always open.

Methodology We analysed the various aspects, clinical features, demographics, epidemiologic factors, treatment received and outcomes in all 500 patients we undertook in our study. It was inferrered that mostly in our ICU patients are refered from medicine and emergency department followed by accident and trauma. Patients of medicine department were of old age and had accompanying Comorbidities (DM, CAD, CKD, liver diseases, ILD, Rheumatoid arthriris). They had to be dealt with utmost care, taking consideration of their co morbities as well as of the underlying cause. The CKD patients, diabetics with AKI etc. are some patients who may need dialysis. Whereas patients refered from trauma and ortho department may be in hypovolemic shock and airway support. Regular ABG assessment for patients on invasive and noninvasive mode was done. SOFA score at admission, then at 24 hours and then at 48 hours was done. ARDS was accessed by Berlin Criteria, KDIGO criteria for AKI and diagnostic stratergies for VAP was used for assessment, prognosis and improvement after treatment.

Requirement of Transfusion, RRT, Invasive Ventilator Support in First 3 days are important criteria for severity acessment and

prognosis. Number of days spent in ICU is inversely propotional to the prognosis of the patient. The SOFA score and 28 day mortality acessment tells us about the course and outcome of various diseases and helps us manage things accordingly

Observation Chart

Table 1: Proforma

ICU DATA

1. Patient Name…….
2. AGE/SEX ……UHID……..
3. Address……..
   …….
   Contact Number……DATE……..

Admission From: Community/Hospital
Co morbidities: HTN/DM/COPD/CAD/CKD/CLD/CVA.
History of Prior ICU Hospitalization: Yes/NO
Department of Admission: Medicine/Ortho,Trauma/Respiratory/Renal/CNS/LIVER/OBS,GYNAE/Other
Diagnosis: ……
SOFA SCORE: At Admission……At 24 Hours…….At 48 Hours……..
Admission ABG: pH…...Po2…….Pco2……..Hco3……...BE…….
AKI : YES/NO
ARDS : YES/NO
SEPTIC SHOCK : YES/NO
VAP: YES/NO
Requirement of Transfusion in First 3 Days: Yes/No
Requirement of RRT in First 3 Days: Yes/No
Requirement of Invasive Ventilator Support in First 3 Days : Yes/No
Total Number of ICU days:
28 Days Mortality Yes/No

Table 2: Sofa (sepsis-related organ failure assessment) scoring

SOFA score	0	1	2	3	4
Respiration					
PaO_2/FIO_2 (mmHg) (kPa)	> 400 > 5.3)	301–400 (4.1–5.3)	201–300 (2.8–4.0)	101–200 (1.4–2.7)	≤ 100 ≤ 1.3)
Coagulation					
Platelets ($x10^3/mm^3$)	> 150	101–150	51–100	21–50	≤ 20
Liver					
Bilirubin (mg/dl) (µmol/l)	< 1.2 < 20)	1.2–1.9 (20–32)	2.0–5.9 (33–101)	6.0–11.9 (102–204)	≥ 12.0 ≥ 204)
Cardiovascular					
Hypotension	No hypotension	MAP < 70 mmHg	Dopamine ≤ 5 or dobutamine (any dose)*	Dopamine > 5	Dopamine > 15
Central nervous system					
Glasgow coma score	15	13–14	10–12	6–9	< 6
Renal					
Creatinine (mg/dl) (µmol/l) or urine output	< 1.2 < 110)	1.2–1.9 (110–170)	2.0–3.4 (171–299)	3.5–4.9 (300–440) < 500 ml/day	> 5.0 > 440) < 200 ml/day

* adrenergic agents administered for at least 1 h (doses given are in µg/kg/min)

Table 3: Interpretation of sofa score

SOFA SCORE	0-6	7-15	>15	MORTALITY/LAMA
AT ADMISSION	143	237	120	

AT 3 HOURS	165	225	100	8 patients died,2 patients LAMA
AT 12 HOURS	160	218	90	9 patients died, 3 patients LAMA
AT 24 HOURS	174	228	90	6 patients died, 2 patients LAMA
AT 36 HOURS	170	217	85	5 patients died, 3 patients LAMA
AT 48 HOURS	172	204	80	4 Died /5 LAMA

SOFA SCORE	NO. OF PATIENTS (mean)	PERCENTAGE OF PATIENTS	DEATHS IN ICU	MORTALITY RATE
0-6	164	32.8%	00	0
7-15	221.5	44.3%	2	.9%
>15	94	18.8%	32	29%

Table 4: Kdigo criteria and its interpretation

KDIGO CRITERIA	NO. OF PATIENTS	MORTALITY	PERCENTAGE
STAGE 1	188	1	.025%
STAGE 2	67	3	4.47%
STAGE 3	45	18	40%

Table 5: Berlin criteria and its interpretation

BERLIN CRITERIA	NO. OF PATIENTS	MORTALITY	PERCENTAGE
MILD	180	2	1.11%
MODERATE	54	9	16.67%
SEVERE	38	11	28.9%

Results

By multivariate analysis, predictors of in-hospital mortality were Sepsis-related Organ Failure Assessment (SOFA) score at ICU admission, the increase in SOFA score over the first 3 days in the ICU, respiratory failure within the first 24 hrs in the ICU, and inadequate empirical antimicrobial therapy were a predictive factors**.** The common indications for ICU admission were hemodynamic instability (58.6%), respiratory failure (27.9%) and sepsis (15.3%). CAD (46.8%) was the most common comorbidity. Mortality rate was 22.3% in all patients. Approximately 62% of all deaths was observed within the first fifteen-day. The prognosis of sepsis and septic shock remains poor, despite the advances in ICU treatment.

In addition, mortality rate (80.7%) was prominent within patients in need of the mechanical ventilation support. Total 32 patients died, and 15 patients took LAMA. Requirement of Transfusion, RRT, Invasive Ventilator Support in First 3 days are important criteria for severity acessment and prognosis. Number of days spent in ICU is inversely propotional to the prognosis of the patient. The SOFA score and 28-day mortality acessment tells us about the course and outcome of various diseases and helps us manage things accordingly

Statistical Analysis:

Data obtained will be analyzed using the Statistical Program for Social Sciences (SPSS) version 20.0. Categorical variables will be summarized using proportions. Chi-square tests or Fisher's exact tests will be used where applicable to compare differences between proportions. Univariate and multivariate analysis will be performed as required. Odds ratio (OR) and respective 95% confidence interval (CI) will be computed. A **p** value < 0.05 shall be considered as statistically significant.

Discussion

Garland et al assessed ICU, hospital, 30-day, and 180-day mortality rates; ICU and hospital lengths-of-stay, ICU care, outpatient physician care, medications, and home care and post-hospital residence location. They explored data stratified by age, sex, and separate categories of geocoded income for urban and rural residents. After ICU admission there was a high initial death rate, which declined between 30 and 180 days and thereafter remained at the lower value. Hospital mortality was 19.0%, with 21.7% dying within 6 months of ICU admission. They concluded that post-hospital medical resource use among ICU survivors is substantial, although similar to that after non-ICU hospitalization. Identifying Post-hospital supports needed by ICU survivors can be useful for policy makers and others responsible for healthcare planning. [3]

Ali ugur et al conducted a study on the common indications for ICU admission, prevalence of mechanical ventilation support, hematological and biochemical parameters and their effects on mortality. Mechanical ventilation requirement, increased ferritin and vitamin B12 levels were independent risk factors for mortality in critically ill patients . They concluded that mortality rate was higher in medical ICU. Herein, increased prevalence of geriatric population, concomitant comorbidities and mechanical ventilation requirements may play role. [4]

JC Orban et al conducted an observational multicenter cohort study in 96 intensive care units. Demographic data, characteristics of organ failures (Sequential Organ Failure Assessment subscore greater than or equal to 3), and organ supports were collected on all patients who died in the intensive care unit. Withdrawal or withholding of treatments accounted for half of the deaths. They concluded that in a general intensive care unit population, the majority of patients present with at least one organ failure at the time of death. Anticipated and unexpected deaths represent two different modes of dying and exhibit profiles reflecting the different pathophysiologic underlying mechanisms. [5]

ME Destky et al conducted a prospective cohort study in three medical ICUs and two surgical ICUs in three hospitals. They measured 6-month outcomes including survival, return to original place of residence, and physical and cognitive function. Factors associated with not returning to baseline included higher APACHE III score, being a medical patient, older age, nonwhite race, recent hospitalization, prior transplantation, and a history of cancer or of neurologic or liver disease. They concluded that patients spending at least 3 days in an ICU and requiring even brief periods of life-sustaining therapy, nearly one-half will be dead and less than one-third will have returned to their baseline status at 6 months. Of those who survive, the majority of patients will be back at home at 6 months. [6]

Kerai S et al did a retrospective analysis of medical records of critically ill patients admitted to intensive care unit (ICU) at the peak period of both waves. The data on demographics, symptoms, treatment received, and outcomes of patients were recorded. Compared to first wave, significantly more females, younger age group, and those without underlying comorbidities required ICU admission during the second wave. There was no significant difference in the duration of ICU stay and mortality of patients. During the first wave, the factors associated with nonsurvival of patients were advanced age, comorbidities, severe disease, and a lesser number of days on HFNC. All these factors along with higher Sequential Organ Failure Assessment (SOFA) score were observed to be linked with patient nonsurvival during the second wave. [7]

Gutiérrez-Cuadra M et al compared risk factors, clinical features and outcome of patients admitted to hospitals with different

levels of health-care. Symptoms or signs on admission were similar. In-hospital mortality rates were not statistically different between hospitals. In the stepwise analysis, independent predictors of mortality were pneumonia on admission and cardiac complications during hospitalization. Mortality of patients with pandemic H1N1 infection was influenced by patients underlying conditions, severity of disease (pneumonia) on admission and complications during hospitalization. Hospital-characteristics do not appear to have influenced severe outcome. [8]

The aim of the study by Rabe C et al was to characterize patients and report outcome of diffuse alveolar hemorrhage (DAH) requiring intensive care unit support. Survival was markedly different between patients with an immunologic/unknown etiology (82%) and patients with thrombocytopenia and/or sepsis (22%). Patients with an immunologic/idiopathic pathogenetic mechanism have a relatively good prognosis, whereas the outcome in individuals with DAH secondary to cancer therapy or sepsis is poor. [9]

Bardi T et al in a retrospective single-centre, case-control study assessed the characteristics and ouctome of ICU-acquired infections in COVID-19 patients. Authors evaluated the epidemiological, clinical, and microbiological features, and outcome of ICU-acquired infections. Fifty-seven patients (40.7%) developed a bacterial or fungal nosocomial infection during ICU stay. In 60% of cases, infection was associated with septic shock and a significant increase in SOFA score. Overall ICU mortality was 36%. Infection was significantly associated with death and a longer ICU stay ($p < 0.001$). [10]

Garnacho-Montero J et al's primary goal was to evaluate the impact on in-hospital mortality rate of adequate empirical antibiotic therapy, in a cohort of patients admitted to the intensive care unit (ICU) with sepsis. The impact of adequate empirical antibiotic therapy on early (<3 days), 28-day, and 60-day mortality rates also was assessed. Authors determined the risk factors for inadequate empirical antibiotic therapy. In patients admitted to the ICU for sepsis, the adequacy of initial empirical antimicrobial treatment is crucial in terms of outcome, although early mortality rate was unaffected by the appropriateness of empirical antibiotic therapy. [11]

The purpose of this review by Schoenberg MH et al was to evaluate recent prospective studies concerning the short- and long-term prognosis of patients suffering from systemic inflammatory-response syndrome (SIRS), sepsis, severe sepsis and septic shock. Approximately 10% of patients in the ICU suffer from sepsis, 6% from severe sepsis and 2–3% from septic shock. The prognosis of sepsis and septic shock remains poor, despite the advances in ICU treatment. Although prognostic factors have been identified for some patients, groups have not yet been able to identify the immediate or long-term prognosis for the majority of these septic patients. [12]

Harris A et al studied epidemiology and clinical outcomes of patients with multi resistant Pseudomonas aeruginosa. Patient characteristics, antibiotic exposures, time course of emergence of resistance, and clinical outcomes were examined. This study illustrates that multi resistant *P. aeruginosa* emerges in a stepwise manner after exposure to antipseudomonal antibiotics and results in adverse outcomes. [13]

Krishnan JA et al prospective cohort study objectives were to assess the consistency of caloric intake with American College of Chest Physicians (ACCP) recommendations for critically ill patients and to evaluate the relationship of caloric intake with clinical outcomes. Study participants were underfed relative to ACCP targets. These targets, however, may overestimate needs, since

moderate caloric intake was associated with better outcomes than higher levels of caloric intake. [14]

Lin SM et al evaluated whether a goal-directed protocol, without measurement of central venous oxygen saturation, would improve survival in medical intensive care unit (ICU) patients with septic shock. This was a prospective, controlled study in a 24-bed medical ICU at a tertiary care hospital. Patients receiving goal-directed therapy also had less risk for developing central nervous system or renal failure than patients without. These benefits may arise from adequate fluid resuscitation, earlier vasopressor administration, rapid shock reversal, and protection of major organ function. With central venous oxygen saturation measurement to detect tissue perfusion, the clinical outcomes may be further improved. [15]

Minhas MA et al did a systematic review and meta-analysis of randomized controlled trials on effect of protocolized sedation on clinical outcomes in mechanically ventilated intensive care unit patients.In mechanically ventilated adults in closed, nonspecialty ICUs, protocolized sedation seems to decrease overall mortality (15%), ICU and hospital lengths of stay (1.73 and 3.55 days, respectively), and tracheostomy (31%) compared with usual care without protocolized sedation. [16]

Clinical outcomes after telemedicine intensive care unit implementation were done by Willmitch B et al in the intensive care units of a five-hospital healthcare system. After 3 yrs of deployment of a telemedicine intensive care unit program, this retrospective observational study of mortality and length of stay outcomes included all cases admitted to an adult intensive care unit and found statistically significant decreases in severity-adjusted hospital length of stay of 14.2%, intensive care unit length of stay of 12.6%, and relative risk of hospital mortality of 23%, respectively, in a multihospital healthcare system. [17]

Lew CC et al did a systematic review on association between malnutrition and clinical outcomes in the intensive care unit. Malnutrition is associated with poor clinical outcomes among hospitalized patients. The prevalence of malnutrition ranged from 38% to 78%. Malnutrition diagnosed by nutrition assessments was independently associated with increased ICU LOS, ICU readmission, IOI, and the risk of hospital mortality. The SGA clearly had better predictive validity than the MNA. The association between malnutrition risk determined by nutrition screening was less consistent. Malnutrition is independently associated with poorer clinical outcomes in the ICU. Compared with nutrition assessment tools, the predictive validity of nutrition screening tools were less consistent. [18]

García Lizana F et al studied long-term outcome in ICU patients. They did analysis of mortality and quality of life (QOL) after intensive care unit (ICU) discharge in a prospective, observational study. Age, past history, admission APACHE II, SOFA score (admission, maximum, discharge), ICU and hospital mortality were recorded. 38% had a worse QOL than prior to ICU admission, but only 8.3% were severely incapacitated. Comparing QOL after discharge with that before admission, patients more frequently report worse QOL for the domains of pain/discomfort and anxiety/depression than for physical domains. Factors commonly associated with a change in QOL were previous problems in the affected domains, prolonged hospital length of stay (LOS), greater disease severity at admission and degree of organ dysfunction during ICU stay. [19]

Higgins DM studied relationship of vitamin D deficiency to clinical outcomes in critically ill patients. The objective of this study is to determine the burden of vitamin D deficiency

in intensive care unit (ICU) patients and determine if it is associated with poor patient outcomes. This study demonstrates significant decreases in vitamin D status over the duration of the patient's ICU stay. Low levels of vitamin D are associated with longer time to ICU discharge alive and a trend toward increased risk of ICU-acquired infection. [20]

Zhu S et al did a registry-based cohort study among 30,830 intensive care unit patients regarding clinical outcomes and risk factors for mortality from ventilator-associated events. Clinical outcomes and mortality risk factors for VAEs were analyzed using propensity score matching (PSM), multivariate regression models, and sensitivity analyses. Patients with VAEs indeed had poorer clinical outcomes. Older age, higher APACHE II score on ICU admission, pneumonia, blood transfusion, immunosuppressive drugs, central-line catheter, and ≥2 VAEs in the ICU were risk factors for all-cause mortality of VAE patients in the ICU. [21]

The APACHE II score was significantly correlated with serum levels of 25(OH)D, parathormone, calcium, and phosphate. Multivariate regression analysis adjusted by other risk factors showed that among all clinical outcomes, admission hypovitaminosis D was associated with longer duration of ICU stay and a high admission of parathormone was associated with in ICU mortality. Ardehali SH et al concluded that disorders of admission serum levels of 25(OH)D, parathormone, calcium, magnesium, and phosphate are related to the presence of multiple causal factors such as severity of disease and are not independently associated with clinical outcomes. Most often they are normalize spontaneously with resolution of the disease process. [22]

Critically ill patients are frequently prescribed sedatives and analgesics to ensure patient safety, to relieve pain and anxiety, to reduce stress and oxygen consumption, and to prevent patient ventilator dysynchrony. Recent studies have revealed that these medications themselves contribute to worsening clinical outcomes. An evidence-based organizational approach referred to as the ABCDE bundle (Awakening and Breathing Coordination of daily sedation and ventilator removal trials; Choice of sedative or analgesic exposure; Delirium monitoring and management; and Early mobility and Exercise) is presented in this study by Pandharipande P et al. [23]

Vincent, JL et al proposed an integrated and adaptable approach to improve patient care and clinical outcomes through analgesia and light sedation, initiated early during an episode of critical illness and as a priority of care. This strategy, which may be regarded as an evolution of the Pain, Agitation and Delirium guidelines, is conveyed in the mnemonic eCASH—early Comfort using Analgesia, minimal Sedatives and maximal Humane care. eCASH aims to establish optimal patient comfort with minimal sedation as the default presumption for intensive care unit (ICU) patients in the absence of recognised medical requirements for deeper sedation. [24,25]

Conclusion

Funding: None

Availability of data and material: Department of Anaesthesiology L.N. Medical College and J.K. Hospital Bhopal.

Code availability: Not applicable.

Consent to participate: Consent taken

Ethical Consideration: There are no ethical conflicts related to this study.

Consent for publication: Consent taken

What this Study Add to Existing Knowledge

ICU epidemiology forms the basis of policy development for infrastructure related

changes in hospital. This study will help in developing understanding among clinicians regarding demographic profile and clinical profile of patients admitted in ICU. Mortality data and its correlating factors will help in making clinical decisions.

Limitations of Study

Sample size may not be adequate enough to make community based conclusions.Patients from surgical ICU will be taken in this study, who are for short term observation and hence can affect the analysis.

Contribution by Different Authors

First author Dr K.K. Thakur Assistant Professor Department of Anaesthesiology L.N. Medical College and J.K. Hospital Bhopal Data collection and statistical analysis

Second author Dr Deepti Agarwal Assistant Professor Department of Anaesthesiology

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L.N. Medical College and J.K. Hospital Bhopal Concept and Guidance

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