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RESEARCH ARTICLE

Quality of Care in Medical Intensive Care Unit: A Study in an Apex Tertiary Care Teaching Hospital of Northern India

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ABSTRACT

Introduction: The endpoint in quality healthcare is evaluating the outcome of care being rendered. In India, the outcome of healthcare provided in intensive care units (ICUs) has not been studied extensively. The study was aimed to observe the outcome of care provided in a medical intensive care unit (MICU) at a tertiary care teaching institution in North India.

Materials and methods: The study was descriptive and cross sectional. Medical records of all patients, admitted from January to June 2011, were analyzed to study demographic, morbidity and mortality parameters. Simplified acute physiology score (SAPS II) scoring was calculated to assess the severity of the admitted patients.

Results: In medical intensive care unit (MICU) from January to June 2011, 203 patients were admitted, and 51.7% of them were admitted from the emergency department. The mean age of admitted patients was 50.62 years, and 59.3% were males. The majority (83.1%) of the patients required mechanical ventilation with an average of 3.8 ventilator days. Reintubation rate was found to be 16.9%. Bedsore rate in MICU was 9.9% of the total, 63.4% of patients required oxygen administration. Average MICU length of stay was 6.5 days with a readmission rate of 2.9%. Mean and median predicted mortality using SAPS II was 31.21% and 27.30% (range 0.1 to 96.6%) respectively. MICU mortality and Hospital mortality of MICU admitted was calculated to be 45.9% and 52.3% respectively. Mean age of the patients who died was 54.23 (range 13 to 98 years). Bed occupancy of MICU was 93.47%.

Conclusion: Sepsis with septic shock was the major cause of mortality. Standardised mortality was found to be 1.47.

Clinical significance: This study focuses on the quality of care in an intensive care unit setting, which is not a priority in developing countries like India. There have been so to say negligible literature on the same especially in developing countries. This study will help us identify the various parameters to measure the quality of care.

Keywords: Critical care, Medical intensive care unit, Outcome of care, Quality of care, Simplified acute physiology score II

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INTRODUCTION

Critical care services are an essential part of the care pathway of many hospital patients and have to be fully integrated into entire hospital services for a better patient outcome. Patients requiring critical care are amongst the sickest in the hospital and require extensive hospital facilities, most importantly dedicated highly skilled multidisciplinary teams.[1] Intensive care units are an essential and key element of critical care services. Governments and healthcare providers around the world are devoting a large proportion of their budgets to maintaining the quality of care in these healthcare setting.[2] In India, there are few ICUs that are well equipped and have the expertise to use modern, sophisticated technology to the patient's advantage.[3] This, coupled with evidence demonstrating numerous challenges encountered with delivery of intensive care services mandates serious and sustained efforts to improve ICU performance.[4]

To document the improvement in ICU performance, it becomes crucial that suitable indicators are measured to indicate the change in performance. Various quality indicators have been mentioned in literature, i.e., measuring outcome (mortality in the ICU, duration of stay over 7 days, mean duration of stay in the ICU, and mechanical ventilation, sub-optimal pain therapy, patient and relatives satisfaction), process (rate of effective pain measurement, standards-compliant transfusion of blood products, prevention of ventilation-associated pneumonia, adequate sedation according to standards, adequate stress ulcer prophylaxis and adequate prophylaxis of deep vein thrombosis), admission/discharge (rate of delayed admission to the ICU, rate of delayed discharge from the ICU, rate of cancelled operations due to lack of ICU beds, emergency admission delays due to lack of ICU beds) and complications (rate of unplanned readmissions on the ICU within 48 hours, rate of catheter-associated sepsis per 1000 CVC days and rate of new infections with multi-resistant organisms).[5] Continuous measurement of the indicators is one method to assess an improvement of performance over time. It should be part of the quality

management system which should be an integral part of the ICU.[6]

While disease outcomes are relatively easy to appreciate, the outcomes in intensive care are not so easy to do so because of the very nature of the units and the way the intensive care units have been organized in our country with a large number of open and very few semi-closed and even fewer closed units.[7] In the context of evolving healthcare, the focus on quality and safety of medical care is increasing because of the high cost of healthcare and potential for harm. Quite logically it has also reached the intensive care community.[8] The endpoint in the quality of healthcare is evaluating the outcome of care being rendered. The commonly studied outcome measures include mortality, morbidity, resource use, and patient-centered outcomes (which incorporate patient preferences for their care and their functional status). All of these measures can be evaluated at various points in time.[9]

Almost all patients are admitted to ICUs with the hope of reversing the immediate illness, thereby avoiding a fatal outcome. Despite dramatic advances in critical care as well as in the treatment, however, death remains a common occurrence in the ICU. An important method to assess outcome of care being delivered in intensive care unit is the standardized mortality ratio using an index of severity [e.g., acute physiology and chronic health evaluation (APACHE), simplified acute physiology score (SAPS), mortality probability model (MPM)].[6] Standardization of most aspects of intensive care medicine has an enormous potential to improve patient care and outcome, reduced ICU/ hospital length of stay as well as healthcare expenditures.[10] In India, there is very limited scientific literature available on the outcome of care rendered in intensive care unit, therefore, this study was conducted to assess the outcome of care being rendered at medicine intensive care unit.

MATERIALS AND METHODS

A descriptive and cross-sectional study was carried out to evaluate the outcome of care provided at MICU of an apex tertiary care teaching institution of Northern India. The study was commenced after getting approval from the Institute Ethics Committee and retrospective analysis of medical records of all patients admitted in MICU, from January 2011 to June 2011, was conducted. Only available data in the medical records of the admitted patients were assessed to study the outcome. The following outcome parameters for the study were selected through a detailed review of the literature (Table 1). SAPS II expanded score and predicted mortality score was calculated to assess the severity of the patients admitted in MICU and standardized mortality rate. SAPS II expanded score was calculated through an online calculator. Wherever parameters needed for calculation of severity assessment were found missing, the value of such parameter was taken to be normal. Derived glasgow coma scale (GCS) score and verbal score were rounded off to arrive at the round figure required for calculation of SAPS II score. Data collected were analyzed using Microsoft Excel 2010 and Statistical Package for the Social Sciences (SPSS) version 16 software.

Table 1: Outcome parameters

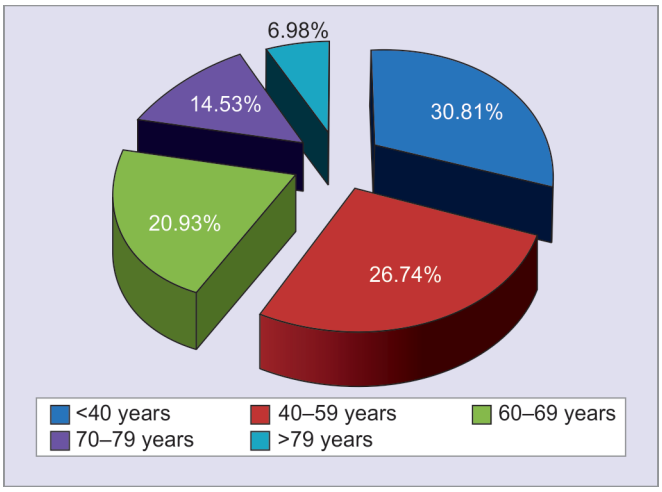
Demographic and general profile of patients
Morbidity
• Length of stay
o ICU
o Hospital
• Diagnosis
• Postoperative/intervention complication
• Vasopressor support
• Oxygen administration
• Ventilator days
• Reintubation within 48 hours
• ICU readmission within 72hours
Severity assessment and predicted mortality
Mortality
• Hospital
• ICU
Standardised mortality

RESULTS

Medical intensive care unit (MICU) is located inside the medicine ward of the hospital. It houses eight patient care beds only, and each MICU bed is state-of-the-art, equipped with modern multi-parameter monitors and ventilators along with bed head panel carrying the service points. There is no full time dedicated designated faculty in charge/head for MICU. It is an open model intensive care unit under the head, Department of General Medicine.

Morbidity in MICU Patients

In MICU over a period of six months, from January 2011 to June 2011, 203 patients were admitted, while records of only 90.64% (172) patients were available for study. MICU received patients mainly from the northern part of the country with 66.9% from Delhi followed by Uttar Pradesh (18.0%), Haryana (6.4%), Bihar (4.7%) and other states. Only 20.9% of patients were referred from other hospital/nursing home, rest 79.1% reported on their own. Referred patients were younger compared to patients self-reporting. About one-tenth, (9.3%) of the patients



Graph 1: Age group of patients admitted in MICU

admitted in MICU were medicolegal patients. All the medicolegal patients presented with poisoning.

Of the total patients, 59.3% (102) patients were males, rest 40.7% (70) were females. Mean and median age of the patients admitted to MICU was 50.62 and 54 years respectively (range 13 to 98 years), (Graph 1). Females admitted to MICU were younger compared to males. A maximum number of patients (30.81%) belonged to the age group of fewer than 40 to 18 years, and 57.55% of the patients admitted were less than 60 years of age. Maximum patients [91.9% (158)], who received MICU care, were admitted through the emergency department and most of the patients in MICU were transferred from the emergency department (51.7%) and inpatient wards (45.9%). Only 2.9% (5) patients were readmitted within 72 hours in MICU during their hospital stay after getting transferred out of MICU.

Of the total admitted patients, 17 (9.9%) patients developed a bedsore during their stay. Case out 51.7% (89) patients required vasopressor support to maintain their circulatory status. About two-thirds (63.4%) of the patients required oxygen administration and 83.1% (143) of the patient's required ventilatory support. In MICU, 649 days of mechanical ventilation was given to admitted patients. A mean and median day of mechanical ventilation in MICU was 3.8 and 2 days (range 0 to 41 days), respectively. Median days of mechanical ventilation required remained constant across all the age groups, referred or non-referred patients, irrespective of survival or otherwise (Table 2). Of the total patients who required ventilatory support, 29 (20.27%) were reintubated within 48 hours of extubation (either unplanned extubation or extubation failure). Patient of the age group 70 years and above had a longer duration of mechanical ventilation compared to others. Mean mechanical ventilation days were longer in females and non-referred patients. Seven patients developed ventilator-associated pneumonia during their

Table 2: Length of stay and ventilator days of patients admitted to MICU

Variable			*Age*		*Hospital LOS*		*MICU LOS*		*Ventilator days*	
		N	*M*	*m*	*M*	*M*	*M*	*m*	*M*	*m*
		172	*51*	*54*	*17*	*12*	*7*	*5*	*4*	*2*
Age Group	*<40 years*	53			14	10	5	5	3	1
	40–59 years	46			18	14	5	5	3	2
	60–69 years	36			16	12	6	6	3	2
	70–79 years	25			24	13	12	4	7	3
	>79 years	12			19	16	7	6	5	3
Gender	Male	102	52	55	16	12	6	5	4	2
	Female	70	49	49	19	14	7	5	4	2
Region-wise	Delhi	115	52	54	20	13	7	5	4	2
	Uttar Pradesh	31	50	55	14	13	7	5	5	3
	Haryana	11	46	40	10	10	5	5	4	4
	Bihar	8	40	36	14	8	5	5	2	1
	Uttara-khand	2	68	68	4	4	2	2	2	2
	Others	5	50	55	11	13	3	3	2	2
Referral status	Referred	35	44	44	18	13	7	6	4	2
	Non referred	136	53	56	17	12	7	5	4	2
Status at discharge from ICU	Trans-ferred to other wards	90	48	50	22	15	7	5	3	2
	Expired	79	54	60	12	8	6	5	5	2

M = Mean and m = Median

MICU stay. Prevalence of ventilator-associated pneumonia was calculated to be 10.78 per 1000 ventilator days.

Mean and median hospital length of stay (LOS) among patients who received MICU care was observed to be 17.3 and 12 days (range 1 to 102 days) respectively. Mean and median MICU length of stay was 6.5 and 5 days respectively (1 to 59 days). Hospital and MICU length of stay was slightly longer in females and increased with the age of the patient. Referral status of the patient had minimal effect on length of stay. LOS was longer in patients who got discharged from the hospital.

Mortality among MICU Patients

Severity assessment of admitted patients was calculated using the SAPS II expanded score and predicted mortality was calculated. Mean and median SAPS II score of patients admitted was 43.69 and 42 (range 12 to 104)

respectively. Average SAPS II expanded score of admitted patients was 6.14 (median 6.11 and range 2.1 to 16.1). Mean and median predicted mortality was calculated to be 31.21% and 27.30% (range 0.1 to 96.6%). SAPS II expanded score and predicted mortality was high among the patients who belonged to other states as compared to Delhi, males and non-referred patients. As expected, predicted mortality was high amongst patient who died during MICU stay.

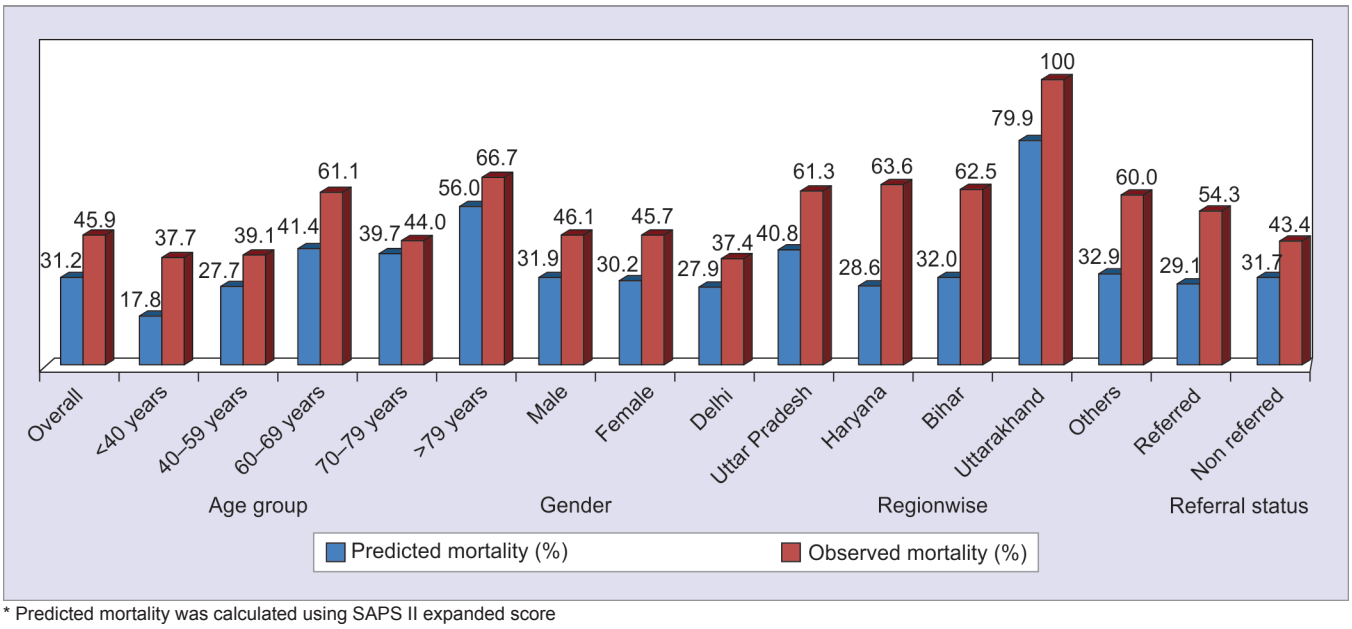
More than half, (53.5%) of the patients were transferred out for further management/treatment and only one patient left against medical advice. Mortality among MICU admitted patients was observed to be 45.9% (79). Number of MICU admitted patients who died before they could be discharged from the hospitals was 6.4% (11), thereby increasing the hospital mortality among MICU admitted patients to 52.3% (90). Mean and median age of the patients who died was 54 and 60 years (range 13 to 98 years), while patients who could be transferred out were younger (mean age–47.86 and median age–49.50 years). More than half (51.9%) of the patients who died during their course of treatment at MICU were greater than 60 years. Maximum mortality in MICU was observed in the age group of 60 to 69 years, which accounted for more than a quarter (27.8%) of patients who died. Similar mortality pattern was seen in patients of less than 40 years (25.3 % patients died). In our study, observed mortality was higher than the predicted mortality using SAPS II expanded score. Observed mortality was higher than the expected mortality across all strata (Graph 2).

Of the 79 patients who died, 59.5% (47) were male, rest females. Observed mortality was comparable and almost equal in males (46.1%) and females (45.7%). As a percentage of males getting admitted to MICU was greater than females, therefore, the number of males dying in MICU was greater. Standardized mortality in MICU was calculated to be 1.47. Sepsis with septic shock was the major cause of mortality. Of the total admitted patients, 22.1% (38) died of sepsis, while it was an associated cause of mortality in more than 10% of patients. Some other observed causes of mortality were pneumonia, acute respiratory distress syndrome, renal failure, etc.

DISCUSSION

This study was done to evaluate the quality of care being provided in MICU by assessing the outcome. Mean and median age of the patients admitted to MICU was 50.62 and 54 years while 59.3% were males. In a study conducted in England, Wales and Northern Ireland (Case Mix Programme), the median age at admission to the general critical care units was 63 years, and 59% of admissions were male.[11] In an Irish multicenter study, the mean age of patients was 57 years, and 62% were male.[12] Most of the patients were admitted in MICU through the emergency department (51.7%). In an study, emergencies comprised 723 (70%) of all admissions and inter-hospital transfers 85 (8.3%), yielding a nonelective admission total of 808 (78.5%) patients.[12]

The study revealed that 17(9.9%) patients developed pressure ulcers. In one veterans administration study, pressure ulcers with a prevalence of approximately 10% were found to be a significant marker for mortality in long-term care patients.[13] The core rate is almost matching with that of a developed country which reflects upon the good nursing and supportive care being provided in the MICU. The majority, (83.1%) of the patient's admitted



* Predicted mortality was calculated using SAPS II expanded score

Graph 2: Predicted and observed mortality of patients admitted to MICU

in MICU required ventilatory support. The mean and median days of mechanical ventilation in MICU patients was 3.8 and 2 days (range 0 to 41 days) respectively. Of the total patients who required mechanical ventilation 20.27% (29) patients were reintubated within 48 hours of extubation. In a study conducted in Ireland, mechanical ventilation was received by 70.7% (728) patients, with 5.5 and 3 days (range 1 to 48 days) as the mean and median length of mechanical ventilation.[12] In a report published by ANZICS, it was reported that 40.7% of patients admitted in ICU received mechanical ventilation.[14] In a prospective study evaluating all patients with planned extubation over the course of a year in a single medical ICU; failed extubation occurred in 15.5%.[15] In this study, the number of patients requiring mechanical ventilation and reintubation rate is slightly higher than the developed countries, however, mean duration of mechanical ventilation required is less.

It was observed that average hospital LOS in MICU admitted patients was 17.3 days, while mean and median MICU LOS was 6.5 and 5 days respectively. In a study done in Northern India, ALOS in MICU patients was calculated to be 3.08 days.[16] Median ICU length of stay among patients of Australia and New Zealand was 1.77, and 1.10 days respectively.[14] In a study carried out in general medicine ICU of Riyadh military hospital ALOS was reported to be 10 days.[17] In a Moroccan intensive care unit ALOS was 5.1 days for those without hospital-acquired infection.[18] It cannot be conclusively said that the MCIU length of stay in this study was significantly higher compared to abovementioned studies, however, total hospital ALOS among MICU admitted patients appears to be on higher side.

Readmission is an indication towards unplanned or an early transfer out from the ICU. In this study, it was observed that 2.9% of patients were readmitted after getting transferred out of MICU. Average ICU readmission rate in North America and Europe is 7%.[19] In a study,[20] it was found that readmissions among seven hospital ICUs ranged from 2.8 to 5.4%, whereas in another study the rate ranged from 3.9 to 9% among the 38 ICUs.[21] Both studies found that teaching hospitals had higher readmission rates than nonteaching hospitals (4.8% and 8.6% vs. 4.3% and 5.2% respectively). A report published by Australian New Zealand Intensive Care Society (ANZICS) showed that 5.2% of patients were readmitted to ICU during their hospital admission.[14] In this study, the readmission rate is less compared to other countries/institutions.

Mean predicted mortality of patients admitted in MICU was calculated to be 31.21% by using SAPS II score. However, the observed mortality was 45.9% while, hospital mortality of patients admitted to MICU was 52.3%. Sepsis with septic shock was the major cause of mortality. In its first-ever report published by ANZICS of 180 ICUs of Australia and New Zealand, the mean (median) predicted risk of death of ICU patients by SAPS II was 30.34 (27) in Australia and 32.73 (29) in New Zealand for 2008.[14] From the 128 hospitals in Australia and New Zealand that contributed data to the adult patient database in 2008, hospital mortality of patients admitted to ICU was 11.1% in Australia and 13.4% in New Zealand.[14] In a study of 53,305 ICU patients in Finland, Sweden, and Norway admitted during 2006, ICU mortality was found to be 9.1%,[22] which is considered low compared with reports from other countries. ICU mortality of patients admitted to Irish ICUs was found to be 17.6%.[12] The mortality data in Croatian ICUs was highest in an ICU for infective diseases (30%), followed by neurological (19%), medical (17%), and respiratory (16%) ICUs.[23]

The predicted mortality in our study is comparable to that being observed in other studies, however, observed mortality is much higher than what has been observed worldwide. The reasons for the same could not be commented on. However, the very obvious cause is the sepsis. Sepsis leading to mortality could be because of different reasons which require a detailed investigation into it. The mortality because of the sepsis is preventable and can be reduced by improving hospital infection control practices, streamlining patient care processes. It is also pertinent to mention that the MICU is a retrofitted structure into award and was not planned initially, hence the current MICU setting is not an ideal setting recommended for an ICU for, e.g., current space is less compared to guidelines issued by Indian Society of Critical Care Medicine, inadequate distance between two ICU beds, nonavailability of handwashing facility (alcohol-based hand rubs have been provided), other support areas shared with ward, etc. The study findings highlight important fact that adding up new patient care services without organizing it adequately can adversely affect the delivery of care services, which in this case could be one of the reasons contributing to morbidity and mortality not directly but indirectly.

CONCLUSION

The institution where this study was conducted has no dearth of trained manpower and state of the art machinery and equipment. However, from the study findings, it can be concluded that patient care delivery system in MICU needs to be studied in further detail and streamlined to make patient care services at par with the patient care being rendered in developed countries. The fact that being an apex institute in the public sector in a developing country, it is overwhelmed by the sheer volume of patients outmatches the available resources

within the institute. Further, the deficiencies in the overall healthcare delivery system of our country, e.g., lack basic preventive healthcare services, diagnostic limitations, presence of chronic diseases, ineffective emergency transport system leading to extended transport times and delayed resuscitation acts as a hindrance in delivering quality healthcare.

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