

Original Article

Prolonged Stay in Intensive Care Unit and Its Predictors in a Tertiary Care Centre of West Bengal, India

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Background : Intensive Care Unit (ICU) is considered as one of the most expensive and complex medical resources of any hospital. Research on ICUs may provide valuable inputs in developing an improved model of patient-care and hospital management and a better utilisation of the scarce resources especially in this ongoing pandemic crisis. ICU Length of Stay has long been used as a surrogate marker for resource utilisation. The following study was conducted in a Tertiary Care Hospital of West Bengal to find out the prevalence of prolonged ICU stay and their related factors.

Methodology : This was an Observational, descriptive type study conducted in an intensive care unit of a teaching hospital of West Bengal during April-September 2021. Potential predictors were analysed along with various clinico-demographic profiles of the study subjects for possible association with prolonged ICU-Length of Stay (LOS >14days).

Results and Discussion : Out of total 287 patients almost 19% patients had a Length of Stay (LOS) of more than 14 days. The patients admitted in the ICU due to surgical trauma, respiratory or neurological cases were more likely to have a prolonged LOS. Patient who had Coagulopathy, Infection, Oliguria or needed Mechanical ventilation or Vasopressor therapy in the first 24-hour following admission had higher ICU stay. The patients having LOS of >14 days had a higher mean APACHE II score.

Conclusion : The predictors identified in this study can be used in targeting this particular group to improve resource utilization and efficiency of ICU.

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Key words : Intensive Care Unit, Length of Stay, Predictors, Resource Utilisation.

Intensive Care Unit (ICU) is a key component in the hospital management which provides a speciality care to patients who are critically ill and require special attention. Their care involves the use of highly complex technological equipment and the work of the large number of specialized staffs employed in these units¹. ICUs care for the most severely ill hospitalized patients and in doing so are one of the most resource demanding and stressful areas of the hospital². The concept of ICU originated during the Poliomyelitis epidemic in 1953 where many patients requiring constant ventilation and monitoring were managed in a specific part of the hospital and were provided one-to-one nursing care. From then on, there was a gradual development in this concept and nowadays ICUs have become a recognisable component of most of the general hospitals even in the developing countries like India³. Patients requiring prolonged resuscitation and treatment in ICUs may develop metabolic, immunological or neuromuscular disturbances or

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Editor's Comment :

- Study on clinical profile and other possible predictors of higher Intensive care unit Length-of-stay can give insight into better utilisation of scarce resources and thus may help to improve efficiency of an intensive care unit.
- Prolonged stay in Intensive Care Unit and its predictors in a tertiary care centre of West Bengal, India.

become dependent on intensive care therapies and may even require prolonged organ support. These patients are sometimes described as being 'chronically critically ill'⁴. The development of these type of patients in the modern healthcare poses a novel challenge for resource utilization in the ICU as well as post-discharge from the hospital⁵.

Since the ICU is one of the most complex and expensive medical resources of a hospital, research on ICUs may provide valuable inputs in developing an improved model of patient-care and hospital management and a better utilisation of the scarce resources. Prolonged ICU stay can adversely affect the outcome by increasing not only the cost of therapy but also the risk of hospital acquired infections, complications and thus mortality. From the operational point of view, it affects the ICU bed availability which may lead to longer waiting time for other critically ill patients. These issues have become all more relevant

in the context of global shortages of trained critical care staffs especially during this ongoing COVID-19 crisis⁶.

Study on utilisation of ICU beds can help plan a better management of patients and facilitate covering more number of patients requiring intensive care. It has been found in many studies that ICU cost per day per patient is remarkably consistent across most of the diagnoses and so ICU Length of Stay has long been used as a surrogate marker for resource utilisation. Another measure is the duration of mechanical ventilation as this is one of the most commonly performed procedures in an ICU set-up⁷.

In this background, the following study was conducted in a Tertiary Medical College of West Bengal to find out the prevalence of prolonged ICU stay and their related factors.

MATERIALS AND METHODS

This was an Observational, descriptive study of longitudinal design conducted in an Intensive Care Unit of a multi-speciality teaching hospital of West Bengal, India. After getting approval from the Scientific Review Committee and Institutional Ethics Committee, this study was conducted which included all the consecutive admission cases in the non-COVID ICU over a six-month period from 1st April to 30th September 2021. As this hospital has no Cardiac Care Unit so patients admitted due to Cardiovascular System abnormalities could not be included in this study. Only the patients staying for more than 24 hours in ICU were considered for inclusion in this study. Data analysed included all the demographic and clinical profile of each new admission. Acute Physiology and Chronic Health Evaluation score (APACHE II)⁸ was used to assess the severity of illness.

Statistical Analysis :

The data were analyzed using SPSS version 20 for windows. Continuous variables were expressed as Mean \pm Standard Deviation (SD). Categorical variables were expressed in absolute and relative frequency and analysed using the Chi-square test. For identification of the significant predictors of prolonged ICU stay, univariate analysis was used and results were expressed as Odds-Ratio (OR) and 95% Confidence Interval (CI). The p-value was considered significant if ≤ 0.05 .

RESULTS

Profile of the study group (Table 1):

Age and Sex : Over the 6-month

period, a total of 321 patients were admitted in ICU and as per the inclusion criteria 287 patients were considered to be included in this study having a mean age of 51.7(± 9.1) years. The majority of the patients (58.8%) were male and in between the age group of 45-64 years.

Nature of admission : Most of the patients (94.5%) were admitted due to non-elective reasons, either having emergency surgical or medical indications.

Severity of illnesses : The mean APACHE II score of the study group was 19 \pm 3.

Outcome of the admitted patients : The ICU mortality rate was found to be almost 29% and majority (83%) of the deaths occurred within 14 days of admission. The difference between the mortality rate of patients having a LOS of less than 14 days and patients having a LOS of more than 14 days was not significant.

Utilisation of Resources :

ICU LOS : Out of total 287 patients 54(18.8%) patients had a Length of Stay of more than 14 days. Overall mean ICU LOS was 4.8 days and group of patients having LOS of >14 days had a mean LOS of 19.7 days.

ICU Ventilation Days : Though majority (46%) of the patients had mechanical ventilation between 1-7 days, almost 6% of the patients were put in Ventilation for more than 21 days. Correlation matrix showed a high correlation between ICU Length of Stay and mechanical ventilation days (Fig 3, pearson correlation coefficient 0.95, $p < 0.05$)

Predictors of prolonged stay (Table 2):

Age : There was no significant differences of LOS between the various age groups.

Sex : The gender differences in the two groups also did not show any statistical significance.

Category	No (%)	ICU Length of Stay		P-value	
		≤ 14 Days (n ₁ =233)	>14 Days (n ₂ =54)		
Age	Less than 19 years	19(6.6)	14(6.1)	5(9.2)	NS
	19-44 years	67(23.3)	55(23.6)	12(22.2)	
	45-64 years	122(42.5)	101(43.3)	21(38.8)	
	More than 65 years	79(27.5)	63(27.0)	16(29.6)	
Sex	Male	169(58.8)	136(58.3)	33(61.1)	NS
	Female	118(41.2)	97(41.7)	21(39.9)	
Type of Admission	Elective	16(5.5)	15(6.4)	1(1.8)	< 0.05
	Non-Elective	271(94.5)	218(93.6)	53(98.2)	
Severity of Illness	APACHE II Score (Mean \pm SD)	19 \pm 3	18 \pm 9	23 \pm 5	<0.05
	Tracheostomy	49(17.1)	12(5.1)	37(68.5)	NS
	ICU Mortality	83(28.9)	69(29.6)	14(25.9)	NS

NS=Not significant ($p > 0.05$)

Table 2 — Possible predictors of Prolonged ICU stay (n=287)				
Predictor	Number of patients	OR for prolonged stay	95% C/I	p-value
Non-elective admission	271(94.5)	4.15	1.81-5.51	< 0.05
Readmission	17(5.9)	2.78	1.17-4.97	< 0.05
Main reason for admission				
Surgical :				
Trauma	79(27.5)	1.9	1.3-3.6	<0.05
Non-trauma Surgical	98(34.1)	0.5	0.2-0.7	<0.05
Medical :				
Respiratory	53(18.4)	2.56	1.23-4.64	<0.05
Neurological	29(10.1)	3.9	2.1-5.3	<0.05
Others	28(9.8)	0.7	0.3-1.2	NS
First 24-hour data				
Coagulopathy	99(34.4)	0.62	0.27-1.42	<0.05
Coma	35(12.2)	1.41	0.33-5.9	NS
Infection	78(27.1)	1.20	0.37-3.89	<0.05
Oliguria	54(18.8)	1.46	.58-3.68	<0.05
Mechanical ventilation	201(70.1)	1.30	1.13-1.69	<0.05
Vasopressor therapy	49(17.1)	1.24	1.18-2.41	<0.05
NS=Not significant (p >0.05)				

Type of admission : The mean ICU LOS of elective and non-elective patients was respectively 4.2±5.3 and 9.6±5.7. This difference was statistically significant.

Readmission : The patients who were readmitted in the ICU had a higher LOS than those who were admitted for the first time OR 2.78 (1.17-4.97)

Main reason for admission : The patients admitted in the ICU due to surgical trauma, respiratory or neurological cases were more likely to have a prolonged LOS.

First 24-hour data : Patient who had Coagulopathy, Infection, Oliguria or needed Mechanical ventilation or Vasopressor therapy in the first 24-hour following admission were more likely to have a prolonged ICU stay.

Severity : The patients having LOS of >14 days had a higher mean APACHE II score and the difference between the two groups was significant.

DISCUSSION

Patients having a prolonged ICU stay form a smaller proportion of total ICU patients, yet they consume a disproportionate percentage of Healthcare Resources. The outcome of patients having a prolonged ICU stay was comparable with those having a shorter stay. The various characteristics of patients having prolonged ICU stay were different from those having a shorter stay, in terms of reasons for admission or physiological abnormalities during admission. These findings helped to determine some of the possible predictors for prolonged stay in ICUs. Patients' severity score (APACHE II) was significantly higher in the group having a prolonged stay. This finding was in accordance to many similar studies done

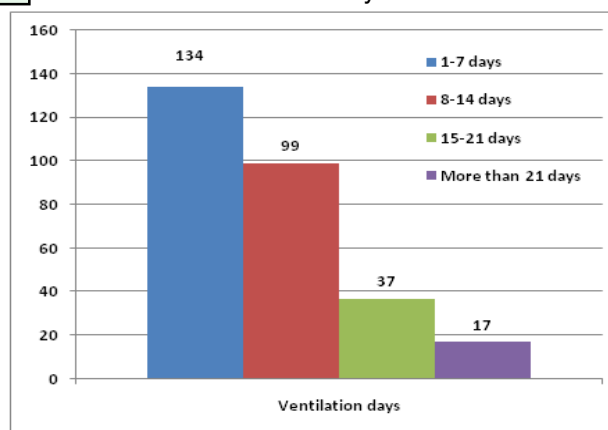


Fig 2 — Distribution of study subjects according to Ventilation day

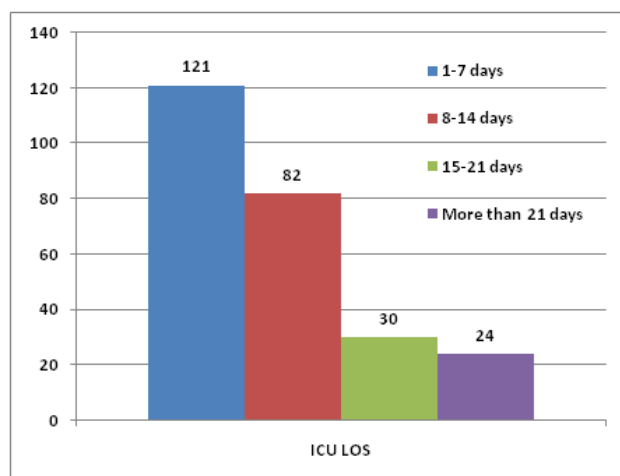


Fig 1 — Distribution of study subjects according to ICU Length of Stay

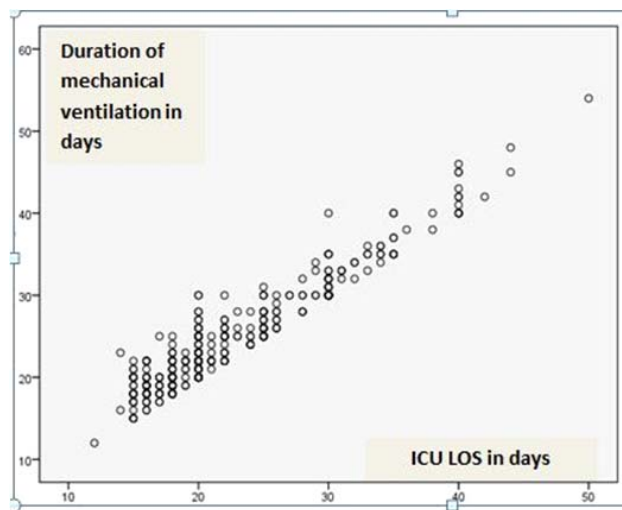


Fig 3 — Distribution of study subjects according to ICU Length of Stay and ventilation days

elsewhere in this topic⁹.

Overall, prevalence of prolonged ICU stay was revealed to be 18.8% in our study. It was higher than most of the studies done on similar topic. Non-elective admissions or the re-admission cases were significantly associated with a prolonged Length of Stay. A strong correlation was found between the duration of mechanical ventilation and ICU Length of Stay. This finding was congruent with many similar studies^{6,9}.

A significantly increased Length of Stay was observed in patients with Respiratory System Diseases and Neurological Diseases. In another prospective study done by Wong, *et al*¹⁰ for patients in ICU, the most common reasons for admission were Neuromuscular Weakness, Pneumonia, Multiple Traumas and Septic Shock. Similarly, Toptas, *et al*¹¹ in a study done in Turkey found that Cardiovascular System Diseases, Nervous System Diseases and Cerebrovascular Diseases to be the most common precursors for increased ICU stay.

Patients having a prolonged ICU stay were more likely to undergo Tracheostomy.

CONCLUSION

A smaller number of Intensive unit admissions consume a great proportion of overall ICU bed-days. The predictors identified in this study can be used in targeting this particular group to improve resource utilization and efficiency of ICU.

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