Original Article
http://mjiri.iums.ac.ir

Medical Journal of the Islamic Republic of Iran (MJIRI)
Iran University of Medical Sciences

Short stay in general intensive care units: is it always necessary?

Mojtaba Sedaghat Siyahkal[1], Farnaz Khatami[2]

Received: 16 April 2014 Accepted: 27 July 2014 Published: 8 December 2014

Abstract

Background: There are challenges ahead of short-term hospitalization of low-risk patients hospitalized only for monitoring of severe disease who may die soon after admission. The purpose of this study was to suggest strategies for the management of ICU stay lengths and to ensure optimal use of ICU resources.

Methods: The study was conducted retrospectively on 246 patients admitted to 9 general ICUs in Tehran, from September 2011 to March 2012. Patients staying for ≤2 days in the ICU were compared to each other after being categorized into two medical and surgical groups.

Results: Of 129 patients with ≤2 days ICU stay (52.4%), 88.4% survived. Of these, 25 (19.4%) were placed in the medical and 104 (80.6%) to surgical groups. Survival rates were significantly greater in surgical group; only 7.7% of them were in need of mechanical ventilation in the first 24 hours of admission ($p<0.001$). In contrast to medical group, the average Acute Physiology and Chronic Health Evaluation (APACHE) II score in the surgical group was significantly lower (9.8±3.6 and 17.3±5.8) ($p<0.001$).

Conclusion: The majority of patients with ≤2 days LOS in the surgical group hospitalized for monitoring after surgery had low mortality rate and APACHE-II score. Therefore, it would seem that transferring such patients to the intermediate care unit leads to more efficient and optimal use of ICU resources.

Keywords: Short Stay, General Intensive Care Units, Medical and surgical group.

Cite this article as: Sedaghat Siyahkal M, Khatami F. Short stay in general intensive care units: is it always neces-sary? *Med J Islam Repub Iran* 2014 (8 December). Vol. 28:143.

Introduction

Allocation of health resources, costs and economization have been matters of concern for decades (1). The Intensive Care Unit (ICU) is a relatively vital part of a hospital, though at a heavy cost (2). According to reports, costs of caring for patients in American ICUs constitute 15-20% of hospitalization costs, 38% of total health costs and 1-2% of Gross Domestic Product (GDP) (3-5). Short-term hospitalization is a challenge ahead in terms of low-risk patients who are hospitalized only for monitoring or patients with severe disease who may die soon after admission (6). Although timely admission to the ICU can prevent early or late mortality of patients, unnecessary ICU admissions can increase the number of patients requiring intensive care resources and can lead to longer waiting time for those in need (7). Therefore, to understand their needs and demands, it is important to examine characteristics of these patients and provide appropriate services to their needs at reasonable prices.

The present study deals with the characteristics of short-stay inpatients (≤ 2 days) hospitalized in general ICUs in terms of outcomes and Acute Physiology and Chronic Health Evaluation (APACHE) II score. According to several studies dealing with short-term admission to ICU, we regarded two days as the average length of stay (LOS) (6, 8). General ICUs were selected because of their numerous services and diversity of their patients. The study results are expected to lead to changes in hospital policies and more efficient and op-

1. MD, Associate Professor, Department of Community Medicine, Tehran University of Medical Sciences, Tehran, Iran. sedaghat.dr@gmail.com
2. (**Corresponding author**) MD, Resident in Community Medicine, Community Medicine specialist, Department of Community Medicine, Tehran University of Medical Sciences, Tehran, Iran. f-khatamik@razi.tums.ac.ir,

timal use of ICU resources.

Methods

The study was conducted in 9 general intensive care units of Tehran University of Medical Science hospitals that possessed no intermediate care unit (IMCU). The sampling method was multistage random sampling. At the beginning, the list of all general ICUs and their number of active beds were obtained. The data were collected retrospectively from September 2011 to March 2012. The number of total patients for each ICU was allocated through proportion to the size of total beds. Therefore it seems that the number of patients according to their type of treatment (medical or surgical) is randomly assigned.

Patient Data Collection

As the target group was the adult population, patients under 12 years of age were excluded from this study. To avoid the effect of extreme outliers, LOS of more than 32 days were truncated to 32 days (9). The final samples consisted of 246 patients. Study variables included age, gender, LOS, disease, APACHE II score, and the need for mechanical ventilation within the first 24 hours of hospitalization. Depending on the diagnosis, patients were categorized into medical (e.g. cerebrovascular accident, chronic obstructive pulmonary disease, etc) and surgical groups (tumor surgeries, hip replacement therapy, etc).The present study was approved by the Ethics Committee of Tehran University of Medical Sciences.

LOS was regarded as the duration of a single episode of ICU admission until the time of discharge or death, and nosocomial infection as a series of local or disseminated infections developed by the pathogenic reactions associated with infectious agent or its toxins at least 48 hours after admission (10-11). The APACHE II score is a scoring-based system to classify the severity of disease, which includes three parts of physiological variables and Glasgow Coma within the first 24 hours of admission to ICU, age and assessment of chronic diseases or single or multiple organ failure in patients. The total obtained score would be the patient's APACHE II score. The increase in score (ranging from 0 to 71) shows an increased risk of hospital death (12).

Statistical Analysis

To study the relationship between qualitative variables, we used Chi-square test or Fisher's exact test. The relationship between quantitative variables was examined using t-test or its non-parametric equivalent and Spearman's correlation coefficient. Logistic regression analysis was used for the predictive power of the variables. IBM SPSS statistics version 19.0.0 was used for statistical analysis. $p<0.05$ was considered as statistically significant level.

Results

During the study period, 129 out of the 246 selected patients (52.4% (CI 95%, 46.2-58.6%)) were hospitalized for two days or less (≤ 2 days). Descriptive and clinical characteristics of patients are shown in Table 1. The mean and median LOS was 6.3 and 2 days, respectively. Table 2 shows the comparison between short-stay (≤ 2 days) and long-stay patients. In the former group, most patients were significantly hospitalized for surgery and were mostly women, with a mortality rate of 6.11%. In addition, this group needed significantly less mechanical ventilation within the first 24 hours of hospitalization. The nosocomial infection was evaluated only in patient with LOS more than 2 days.

Patients stayed for ≤ 2 days were compared in terms of medical and surgical cares. The results are shown in Table 3. Compared to the medical group, the surgical group significantly survived more and was mostly composed of female patients. These patients also needed less mechanical ventilation within the first 24 hours of hospitalization.

In logistic regression analysis, R2 was calculated at 0.32 for patients admitted for two days or less or more than two days.

Table 1. Descriptive and clinical characteristics of the patients

Variables	n (%)	Mean (Interquartile range)
Total	246	
Gender		
Male	115 (46.7)	
Female	131 (53.3)	
Diagnosis		
Medical	76 (30.9)	
Surgical	170 (69.1)	
Survival in ICU		
Alive	197 (80.1)	
Dead	49 (19.9)	
Mechanical ventilation in first 24 hours		
Yes	63 (25.6)	
No	183 (74.4)	
Nosocomial infection		
Yes	47 (19.1)	
No	199 (80.9)	
Age, yrs		52.88 (32.7-71.2)
APACHE II, score		14.24 (10-18.5)
LOS, days		6.3 (1-7)

Table 2. Comparison between short-stay (≤ 2 days LOS) and long-stay (> 2 LOS) patients

Variables		LOS (day)		p
		LOS≤2 n (%)	LOS>2 n (%)	
Total		129 (52.4)	117 (47.6)	
Diagnosis	Medical	25 (19.4%)	51 (43.6%)	<0.001
	Surgical	104 (80.6%)	66 (56.4%)	
Survival in ICU	Alive	114 (88.4%)	83 (70.9%)	0.001
	Dead	15 (11.6%)	34 (29.1%)	
Sex	Male	51 (39.5%)	64 (54.7%)	0.017
	Female	78 (60.5%)	53 (45.3%)	
Mechanical ventilation in first 24-hour	Yes	17 (13.2%)	46 (39.3%)	<0.001
	No	112 (86.8%)	71 (60.7%)	

The analysis results indicated that only variables of age and nosocomial infection remained in the model. Thus, by assuming other variables to be constant, the chance of hospitalization for more than two days in patients will be equal to 1.03 for each year increase in patients' age (CI 95%, 1.01-1.05).

The average age of patients in the surgical and medical groups were 61±22.8 and 49±20.8 years, respectively (p<0.001)

It is noteworthy that 186 (12%) of 1563 beds were occupied by short-stay patients (≤ 2 days), of which 152 (9.7%) were occupied by 104 inpatients in the short-stay surgical group. Considering that the mean LOS was 2 days, the number of beds occupied by patients in the surgical group was 76 in a period of 6 months (13 beds per month).

A significant trend in APACHE II score was detected in 181 (74%) out of 246 people, with the average score of 14.24±6.01. In addition, the length of stay increased with the increase in APACHE II score (p<0.001, r=0.39). A significant difference (p<0.001) was revealed between the average APACHE II scores in short-stay patients (11.5±5.2) and in long-stay patients (16.1±5.8). The average APACHE II score in the surgical group was significantly lower than that in the short-stay medical group (9.8±3.6 and 17.3±5.8 respectively) (p<0.001).

Discussion

ICUs consume the major share of hospital budgets (2). Scarcity of resources is the main problem in ICUs, which requires appropriate allocation of health resources and

Table 3. Comparison between short-stay (≤ 2 days LOS) medical and surgical groups

Variables		LOS ≤2 days		p
		Surgical group n (%)	Medical group n (%)	
Total		104 (80.6)	25 (19.4)	
Survival in ICU	Alive	101 (97.1)	13 (52)	<0.001
	Dead	3 (2.9)	12 (48)	
Sex	Male	33 (31.7)	18 (72)	<0.001
	Female	71 (68.3)	7 (28)	
Mechanical ventilation in first 24-hour	Yes	8 (7.7)	9 (36)	0.001
	No	96 (92.3)	16 (64)	

effective use of available facilities (13). Proper planning and the provision of more efficient and more targeted services will enable us to provide higher quality care and ensure the optimal use of resources.

The present study shows that over 50% of inpatients in ICU are hospitalized for two days or less. These patients, who can survive most often (88.4%), have a low APACHE II score and need mechanical ventilation within the first 24 hours of hospitalization in less than one-fifth of cases. It should be noted that there are 80.6% of short-stay patients (≤ 2 days LOS) in the surgical group, with the mortality rate of 2.9%.

Therefore, our study showed a significant difference between surgical and medical groups. For instance, in the surgical group, most patients were alive at discharge; only 7.7% needed mechanical ventilation within the first 24 hours of hospitalization, and had a low APACHE II score. Hence, when planning for the health system, surgical group should be considered distinctively different from the medical group.

In a considerable number of studies dealing with unnecessary hospitalization and non-optimal use of ICU resources, the average LOS is approximately two days. In a research by Weissman, the mean length of stay was 2.7 with skewness to the right, which means too short or too long hospital stays (14). In their study in 2010, Zimmerman et al. concluded that patients with an average hospitalization of 1.8 days and mortality rate of 2.5% needed no intensive care (6).

In a study by Junker, LOS for patients with less than 10% risk was 2.6 days, and the mortality rate was 2.3% (8). A study by Yaseen in Saudi Arabia showed that the 27.8% of those who were admitted in general ICU for less than 24 hours were inpatients. The mortality rate was 26.3%, and 45.4% have used ICUs. One third (32.6%) of electively hospitalized patients comprised of young patients who have a low rate of chronic diseases and mortality (15).

In addition, short-stay patients (≤ 2 days LOS) accounted for 12% of ICU bed days from which (9.7%) 152 bed days were occupied by patients in the surgical group. Therefore, in our 6-month study, 76 ICU beds (about 13 beds per month) were occupied by patients in the surgical group who stayed for two days or less. According to the results, we can assume that most of these patients are admitted to ICU to be monitored after surgery (rather than receiving any special care). Given the scarcity of ICU resources and shortage of supply relative to demand, we should take appropriate measures for patients in the surgical group who stayed for two days or less. An appropriate strategy can be establishment of IMCU, which would lead to cost savings (16-17). A study in the neurology department showed that the patients who were only monitored during the first day of ICU admission and received active treatment in less than 10% of cases, could be easily transferred to IMCU (18). Thus, establishing these types of units could lead to an increase in the number of disposable beds in ICU, prevent surgical delays, decrease nosocomial infection caused by too long stay in hospital before surgery, and finally effective use of resources. Therefore, developing and implementing protocols to iden-

tify patients who hardly benefit from the ICU services most likely will lead to a decrease in the number of ICU admissions and cost effectiveness. From the limitations of this study include the limits assumed to be cross sectional study and the relatively low number of recruited patients. A national survey regarding this issue is suggested.

Conclusion

The present study provided an opportunity to assess low-risk patients with short LOS. Non-optimal use of ICU beds can be avoided by identifying patients who hardly benefit from the special ICU services. Although timely admission to ICU prevents early or late rate of mortality, unnecessary ICU admission can cause unnecessary high costs, restriction of disposable beds and long waiting time for in need patients. A strategic approach in this regard is establishing IMCUs, which can increase ICUs' disposable beds. As there is no such unit in Iran, we could not evaluate their efficiency and cost-effectiveness. Thus, well-designed controlled interventional studies are recommended to compare IMCU and ICU admission indices and related cost effectiveness.

Acknowledgements

We would like to thank the ICU supervisors and the medical personnel who helped us in the process of data collection.

Conflict of interest

Authors declared no conflict of interest.

References

1. Stricker K, Rothen HU, Takala J. Resource use in the ICU: short- vs. long-term patients. Acta Anaesthesiol Scand. 2003; 47: 508-515.

2. Trottier V, McKenney MG, Beninati M, Manning R, Schulman CI. Survival after prolonged length of stay in a trauma intensive care unit. J Trauma. 2007; 62: 147-150.

3. Halpern NA, Pastores SM, Greenstein RJ. Critical care medicine in the United States 1985-2000: an analysis of bed numbers, use, and costs. Crit Care Med. 2004; 32: 1254-1259.

4. Luce JM, Rubenfeld GD. Can healthcare be reduced by limiting intensive care at the end of life? Am J Respir Crit Care Med. 2002; 165: 750-754.

5. Thomas SN, McGwin G, Rue LW. The Financial Impact of Delayed Discharge at a Level I Trauma Center. J Trauma. 2005; 58: 121-125.

6. Zimmerman JE, Kramer AA. Model for identifying patients who may not need intensive care unit admission. J Crit Care. 2010; 25: 205-213.

7. Messaoudi N, Cocker JD, Stockman B, Bossaert LL, Rodrigus IE. Prediction of Prolonged Length of Stay in the Intensive Care Unit after Cardiac Surgery: The Need for a Multi-institutional Risk Scoring System. J Card Surg. 2009; 24: 127-133.

8. Junker C, Zimmerman JE. Alzola C, Draper EA, Wagner DP. A multicenter description of intermediate-care patients: comparison with ICU low-risk monitor patients. Chest. 2002; 121: 1253-1261.

9. Kramer AA, Zimmerman JE. The relationship between hospital and intensive care unit length of Stay. Crit Care Med. 2011; 39: 1015-1022.

10. Vincent JL. Nosocomial infections in adult intensive care units. Lancet. 2003; 361: 2068-2077.

11. Ghorbanibirghani A, Asadpour S. Nasocomial infection in Intensive Care Units of aria hospital of Ahvaz. Modern Care, Nursing Journal of Birjand University of Medical Sciences. 2011; 8: 86-93. (Persian)

12. Rahimzadeh P, Taghipuranvari Z, Hassani V. Estimation of mortality rate of patients in surgical intensive care unit of Hazrat-Rasul hospital of Tehran using the APACHE II standard disease severity scoring system. Hakim Research Journal. 2008; 11: 22-28. (Persian).

13. Cuthbertson BH, Webster NR. The role of the intensive care unit in the management of the critically ill surgical patient. J R Coll Surg Edinb. 1999; 44: 294-300.

14. Weissman C. Analyzing intensive care unit length of stay data: problems and possible solutions. Crit Care Med. 1997;25: 1594-1600.

15. Arabi Y, Venkatesh S, Haddad S, Malik SA, Shimemeri AA. The characteristics of very short stay ICU admissions and implications for optimizing ICU resource utilization: the Saudi experience. Int J Qual Health Care. 2004; 16: 149-155.

16. Byrick R, Mazer CD, Caskennette GM. Closure of an Intermediate Care Unit, Impact on Critical Care Utilization. Chest. 1993; 104: 876-881.

17. Osborn TM, Tracy JK, Dunne JR, Pasquale M, Napolitano LM. Epidemiology of sepsis in patients with traumatic injury. Crit Care Med. 2004; 32: 2234-2240.

18. Zimmerman JE, Junker CD, Becker RB, Draper EA, Wagner DP, Knaus WA. Neurological intensive care admissions: identifying candidates for intermediate care and the services they receive. Neurosurgery. 1998; 42: 91-101.