Original Article

CRITERIA FOR PATIENT ADMISSION TO AN INTENSIVE CARE UNIT AND RELATED MORTALITY RATES

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ABSTRACT

OBJECTIVE. The aim of this study was to evaluate the criteria used in clinical practice to triage patients who are candidates for ICU admission.

METHODS. This was a prospective cohort study conducted at a tertiary hospital. Patients were assessed for their need for ICU admission and ranked by priority into groups 1, 2, 3 and 4 (highest priority 1, lowest priority 4) and these groups were compared.

RESULTS. The sample comprised 359 patients with a median age of 66 years (53.2-75.0). Median APACHE II score was 23 (18-30). The ICU granted 70.4% of requests for ICU beds. Patients who were refused admission to the ICU were older, 66.2±16.1 vs. 61.9±15.2 years (p= 0.02), and fewer priority 1 patients were refused ICU beds; 23.8% vs. 39.1% of requests refused (p=0.01). The opposite was observed with priorities 3 and 4. Priority 3 and 4 patients were older, scored higher on the prognostic scale and the organ dysfunction scale and had a higher bed refusal rate. Patients in priority groups 3 and 4 had higher in-ICU mortality rates when compared to priority 1 and 2 patients: 86.7% vs. 31.3% (p<0.001).

CONCLUSION. Age, prognostic scores and organ dysfunction scores were all greater among priority 3 and 4 patients and were related to refusal of ICU admission. Patients refused admission to the ICU had higher mortality rates and mortality remained higher among priority 3 and 4 patients even when they were admitted to the ICU.

KEY WORDS: Patient admission. Intensive care unit. Prognosis. Patient selection. Mortality.

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INTRODUCTION

There is a worldwide shortage of the specialized intensive care beds needed to meet the demand of eligible patients[1,2] and this is one of the principal factors limiting intensive care unit (ICU) admissions. The fact that so much is spent on these high-technology resources means that care should be taken to ensure that these beds are occupied by patients with a real likelihood of recovery[3-6].

In the United States, the Society of Critical Care Medicine (SCCM) has developed criteria for ICU admission[3], with the objective of prioritizing, during the triage process, admission of patients who will most benefit from intensive care and in order to improve allocation of available resources. The criteria classify patients into one of four admission priorities, from priority 1 – severe, unstable patients who need intensive care and monitoring in an ICU – to priority 4 – patients for whom admission to an ICU is not indicated because they are too well or too sick to benefit from treatment in intensive care.

It is therefore necessary to rationalize management of the admission of patients to ICUs, particularly when beds are in short supply. The result of this is that very often the patients chosen are those who are most critical, who have multiple dysfunctions and for whom few treatment options remain, which in turn limits monitoring of patients with potential risks meaning that they are treated later and in a worse condition[7]. The SSCM criteria[3] may therefore be of utility with regard to this problem, since they are easy to implement and of a more objective nature than those used in clinical practice, which generally follow a severity-based model and are very often based on complex mathematical calculations or highly subjective assessments.

The objective of the present study was therefore to correlate the patient triage process for ICU admission at a public tertiary hospital with the criteria suggested by the SCCM[3] and to identify factors related with refusal of admission to intensive care.

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Methods

After approval by the institution's Ethics Committee, which waived the need for free and informed consent forms, a prospective observational cohort study was conducted from 1st July to 30th September of 2005 in a 28-bed intensive care unit at a public tertiary hospital.

The intensive care team is coordinated daily by one specialist physician and one specialist nurse, medical residents provide care under the supervision of treating physicians. The patient/physician ratio is 8, the patient/nurse ratio is 5, and the ratio between patients and technicians and nursing auxiliaries is 2, with the exception of patients on dialysis, for whom the ratio is 1 to 1. The ICU has microprocessor-controlled ventilators, invasive and non-invasive hemodynamic monitoring, hemodialysis, endoscopy and bronchoscopy, which can be provided to all patients 24 hours a day.

The inclusion criteria for this study were age over 18 and request for a bed in the ICU. The patients enrolled were clinical cases (from emergency or the wards), surgical cases (elective or urgent) or surgical cases with clinical complications.

Therefore, all patients over the age of 18 years for whom an ICU place was requested were classified into one of four distinct groups, according to the ICU admission priority criteria.3 Group 1 comprised critically ill patients who were unstable and needing intensive treatment and monitoring, with significant likelihood of recovery; group 2 contained stable patients who required intensive monitoring because of the possibility of decompensation; patients in group 3 were unstable, but had a low likelihood of recovery because of the severity of acute disease or because of comorbidities; patients in group 4 had little or no anticipated benefit from ICU admission.

The APACHE II (Acute Physiology and Chronic Health Evaluation II)8 and MODS (Multiple Organ Dysfunction Score)9 scores, which are based on physiological, and laboratory variables, age and prior comorbidities, were calculated on the basis of the worst values for the parameters used in the scores recorded during the first 24 hours after the ICU place was requested. Information collected as the study progressed included demographic data, origin and referring service, diagnoses, mechanical ventilation requirement, vasoactive drugs, renal therapy, coma status, ICVU place priority, availability or nonavailability of ICU places, length of stay in ICU and in hospital, if stay continued after ICU discharge, and presence of chronic diseases.

Patients were followed until discharge or death in hospital and the researcher had no influence whatsoever on the decisions made by the medical team allocating ICU places and treating patients.

At the time the study was conducted the institute had no policy guidelines on allocating ICU places. Assessments of the merit of ICU admission were made on the basis of availability and the knowledge and experience of the head physician, who is the intensive care specialist with the most experience at the institution.

Data were expressed as mean ± standard deviation, median (interquartile range) or percentages. For statistical analysis, the Mann-Whitney test was used for variables without normal distribution and for ordinal variables. These variables were described as medians with interquartile ranges. Categorical variables were analyzed using the chi-square test. ANOVA was used to analyze more than two continuous variables together.

A multivariate analysis was conducted using the "enter" method with the objective of identifying independent risk factors and of controlling confounding effects (mutually adjusted variables). Variables that demonstrated a probability of significance (p value) of less than 0.05 in the univariate analysis were considered as candidates for the multivariate regression model. All probabilities of significance (p values) are two-tailed and values below 0.05 were considered statistically significant. Odds ratios and their 95% confidence intervals were estimated using logistic regression. Survival analyses were conducted using the Kaplan-Meier method and compared using the log rank test. Statistical analysis of the data was performed using SPSS 13.0.

Results

A total of 359 patients met the inclusion criteria and were enrolled on the study. The median age was 66 (53.2-75) years, and 52.6% were female. Median APACHE II and MODS scores were 23 (18-30) and 5 (3-8) respectively. The ICU mortality rate was 34.8% and the hospital mortality rate was 42.9%.

Surgical patients predominated (56.9%). From the total number of requests for ICU places, 66.6% were admitted and 70.4% of requests were granted, since some patients died or improved before being admitted to intensive care. The greatest cause of admission to the ICU was septic shock, accounting for 5.5 % of cases.

Time in hospital before admission to the ICU was high, with a median of 12 (5-26) days.

From the whole sample, 34.6% were classified as priority 1, 52.4% as priority 2 and 14% as priority 3 or 4.

The priority 4 patients were older (mean age of 71.5 years) and priority 3 patients had higher APACHE II and MODS scores (means of 34.9 and 7.8 respectively). Surgical patients predominated in the priority 2 group (90.2%) and clinical patients dominated the priority 4 group (89.5%), referred from the wards (Table 1).

Septic shock was the most common diagnosis in the priority 3 and 4 groups (25.9% and 21.2% respectively). Furthermore, more priority 3 and 4 patients were put on mechanical ventilation (76.9% and 64.7%) and more went into coma, whether induced by sedatives or not (30.8% and 35.3%), when compared with the priority 1 and 2 patients (Table 1).

More priority 1 and 2 patients had no preexisting diseases (20.5% and 16.9%) when compared with groups 3 and 4 (8.3% and 6.3%) (Table 1).

Lengths of stay in both ICU and hospital were greater among the priority 4 patients with means of 28.8 and 38.3 days (Table 1), respectively.

The analysis broken down by whether beds were refused or granted indicated that age, the origin (referring service) of patients and priorities 1, 3 and 4 were the factors that determined whether an ICU bed would be refused or not ($p \leq 0.05$). Death while in hospital was more common among patients who had been refused ICU beds 52.8% (Table 2).

The variables that conferred greatest risk according to the univariate analysis were subjected to a multivariate analysis with the objective of avoiding confounding factors. The only protective factor against ICU bed refusal was a priority 1 classification (Table 3).

Classification of these patients into priorities demonstrated that priority 1 and 2 patients received a greater benefit from ICU admission than priority 3 and 4 patients, since mortality was greater among priority 3 and 4 patients when they were admitted to the ICU (Figure 1).

The Kaplan Meier curve demonstrates that survival of priority 1 and 2 patients was greater than survival of priority 3 and 4 patients (Figure 2).

Discussion

OThese results show that the criteria employed by the physicians responsible for allocating ICU places - the head doctor of each shift - selected priority 1 and 2 patients and that these patients did indeed benefit more from ICU treatment. The univariate analysis comparing places granted and refused detected that a greater percentage of places were granted to priority 1 patients and refused to priority 3 and 4 patients. Furthermore, the multivariate analysis showed that priority 1 status was an independent protective factor for refusal of places in the ICU.

When priority 3 and 4 patients are admitted to the ICU, their mortality is greater than that of priority 1 and 2 patients, in addition to spending longer in both the hospital and the ICU, which suggests that priority 1 and 2 patients benefit more from admission to the ICU than priority 3 and 4 patients, and that classifying patients for admission triage is an efficient way of using the available resources.

Appropriate use of intensive care resources is of fundamental importance because of the shortages of beds both in Brazil and worldwide[1,2], and because of the high levels of investment committed to these specialized centers for the treatment of critical patients. In an initiative to standardize conduct for triage of candidates for admission to intensive care, the Society Of Critical Care Medicine (SCCM) developed criteria for assessing priority when allocating ICU places[3], with patients classified to one of four priority levels depending on the severity of the case.

In this study it was observed that patients classified as priority 3 and 4 were older, had a greater number of comorbidities and had higher prognostic scores and organ dysfunction scores, in addition to having higher rates of mechanical ventilation, coma, septic shock and refusal of ICU admission. This is in line with the literature which lists independent factors for admission to the ICU as lower age, lower prognostics scores and fewer chronic diseases (especially cardiovascular conditions), especially in clinical patients[10].

The rate of refusal of ICU places was approximately 30% of the number of requests, within the percentage expected from the literature, which is 16 to 51.2%[11-15], and which increases as the number of clinical patients increases in relation to the number of surgical patients[16-17].

Griner identified two conditions under which ICUs do not offer increased benefit over conventional care and these are the extreme ends of the risk of death scale – extremely low risk and extremely high risk.3,18 Defining these two groups would be difficult on the basis of diagnosis alone, for example, patients with exogenous intoxication are often admitted to ICUs. Nevertheless, Brett et al.19 demonstrated that patients without certain clinical criteria of high risk will never require ICU procedures and yet, even so, 70% of them are admitted to ICUs for observation.

There is also the specific criterion of a "substantial benefit" of admitting a patient to an ICU, which is subject to interpretations[3,18]. Paz et al. examined admissions to ICUs among patients recovering from bone marrow transplantation; the rate of ICU discharge among those who required mechanical ventilation was 3.8%, compared with 81.3% among those who did not need this support[20]. Other publications have also identified low survival rates (2.5% to 7.0%) among bone marrow transplant patients who required ventilatory support.[21-23] So, is there a "substantial benefit" to be gained from admitting these patients to an ICU? The answer to this question will change from physician to physician and institution to institution.

It is because of this that selection of patients for the allocation of ICU beds has become a relevant subject; especially with respect to admission criteria and from the perspective of allocating places to patients with a good chance of recovery.[3]

Despite the apparent practicality of this subject, there is a subjective side to it because unfortunately the few studies that have investigated the indications for and the results of admission to ICUs have detected an inability to categorize patients with precision[3,18,24-26]. Other studies have shown that there is a lack of precision to predictions of ICU patient mortality and morbidity[27], particularly for cancer patients[28-29]. Furthermore, prognostic scores are not always precise methods of determining patient outcome. The APACHE II score[8], for example, was developed with a general intensive care population and not in specific populations and it is implemented for global assessment of ICUs and not individual patients. In contrast, the MODS score[9] only assesses organ dysfunction and was developed for daily assessments to evaluate patient progress, and is not therefore capable of indicating hospital prognosis with a single assessment.

Additionally, in this study the length of hospital stay prior to admission to the ICU was 12 days. This figure could suggest unfavorable development of a disease that initially was not an indication for intensive care or it could demonstrate delay in admission to the ICU, which would undoubtedly have contributed to exacerbation of clinical status, development of sepsis and progressive dysfunction of multiple organs and systems[30], greatly reducing the probability of recovery, even with all the treatment available in the ICU.

Goldhill et al. have shown that the length of time in hospital before admission to the ICU is an independent predictor of mortality and the greater this time the greater mortality becomes[31]. In a study conducted at five hospitals in Israel[1],researchers observed that survival was greater among patients admitted to intensive care during the first 3 days after deterioration of clinical status. Such delays in admission reflect both shortages of specialized beds in intensive care and delays in diagnosis of pathologies that demand an ICU place, as shown by one study in which just 31% of patients with severe sepsis and septic shock were diagnosed as such by the emergency department team[7].

In the univariate analysis, the patients refused admission to the ICU were older than the patients who were admitted (66.2 ± 16.1 vs. 61.9 ± 15.2; $p=0.02$), but this difference was not maintained in the multivariate analysis. Studies with elderly patients have shown that prior functional status and severity of

Table 1 - Characteristics of patients according to priority classification

Variables	Characteristics				p
	Priority 1	Priority 2	Priority 3	Priority 4	
Age*	63.6±13.9	61.3±16.1	69.0±13.3	71.5±16.5	0.014
APACHE*	27.3±8.6	20.8±7.4	34.9±10.5	23.5±0.7	<0.001
MODS*	6.8±3.6	3.9±2.9	7.8±2.4	5.0±4.2	<0.001
Sex- female %	54.1	51.9	51.9	47.4	0.949
Patients %					<0.001
Clinical	72.9	9.3	100	89.5	
Elective surgical	2.5	90.2	0.0	10.5	
Urgent surgical	24.6	0.5	0.0	0.0	
Referrer %					<0.001
Emergency	33.1	2.2	19.0	3.3	
Surgery	28.1	81	3.8	5.6	
Wards	38.0	16.8	73.1	55.6	
Others a	0.8	0	3.8	0	
Previous disease (%)					0.005
Cardiovascular	51.3	65.7	45.8	56.3	
Renal	9.4	4.1	8.3	6.3	
Immunodepression	3.4	2.3	12.5	18.8	
Respiratory	10.3	10.5	16.7	12.5	
Hepatic	5.1	0.6	8.3	6.3	
None	20.5	16.9	8.3	6.3	
Septic shock %	6.4	0	25.9	21.2	0.010
Mechanical ventilation invasive %	66.7	29.1	76.9	64.7	<0.001
Vasoactive drugs %	46.2	16.7	42.3	35.3	<0.001
Dialysis%	14.3	2.9	11.5	0.0	0.002
Coma %	25.4	3.5	30.8	35.3	<0.001
ICU stay*	7.6±10.8	4.4±7.6	6.7±4.2	28.8±24.3	<0.001
Hospital stay*	28.3±35.5	21.5±18.6	26.8±26.7	38.3±59.0	0.044
Hospital stay before ICU admission*	22.4±37.0	20.4±17.5	21.2±30.0	11.0±10.0	0.817

* mean, a= other intensive care unit or other hospital, Coma may or may not have been induced with sedatives.

Table 2 - Comparison between ICU places granted and refused

Variables	Places refused (n=107)	Places granted (n=252)	p
Age (years)	66.2±16.1	61.9±15.2	0.02
Male (%)	40.6	50.4	0.08
Female (%)	59.4	49.6	
APACHE II	26.6±10.7	23.9±8.8	0.21
MODS	5.3±3.1	5.2±3.6	0.92
Patients (%)			0.002
Clinical	56.8	37.1	
Elective surgical	40.6	51.4	
Urgent surgical	2.8	11.6	
Referrer (%)			0.003
Wards	45.0	25.0	
Surgery	39.0	58.5	
Emergency	15.0	16.1	
Other hospital	1.0	0.4	
Previous disease (%)			0.18
Cardiovascular	57.0	59.1	
Renal	7.5	5.9	
Immunodepression	7.5	3.0	
Respiratory	14.0	9.7	
Hepatic	1.1	3.8	
None	12.9	18.6	
Coma (%)	14.6	15.3	0.87
Dialysis (%)	7.2	8.0	0.80
Invasive ventilation (%)	46.9	48.5	0.80
Vasoactive drugs (%)	24.7	32.1	0.18
Death in hospital(%)	52.8	38.5	0.01
Length of hospital stay	23.0±22.2	25.8±31.7	0.410
Priority (%)			0.00
1	23.8	39.1	0.01
2	47.6	54.4	0.29
3	19.0	2.8	0.00
4	9.5	3.6	0.03

Table 3 - Multivariate analysis of ICU places refused

Variables	p	OR	95%CI	
Priority 1	0.031	0.292	0.096	0.891
Priority 3	0.153	2.616	0.700	9.780
Priority 4	0.993	1.007	0.234	4.337
Age	0.250	1.010	0.993	1.029
Referrer	0.131			
Clinical	0.526	1.365	0.522	3.568
Elective surgical	0.118	0.431	0.150	1.237
Urgent surgical	0.391	0.519	0.116	2.324

Figure 1 – Outcomes of patients admitted to the ICU by admission priority. Mortality was greater among priority 3 and 4 patients ($p<0.001$)

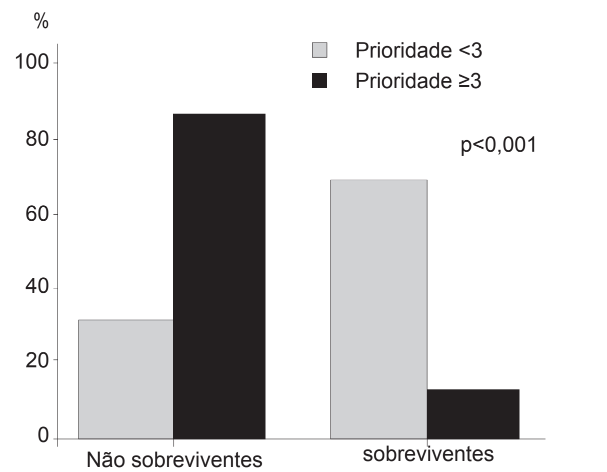
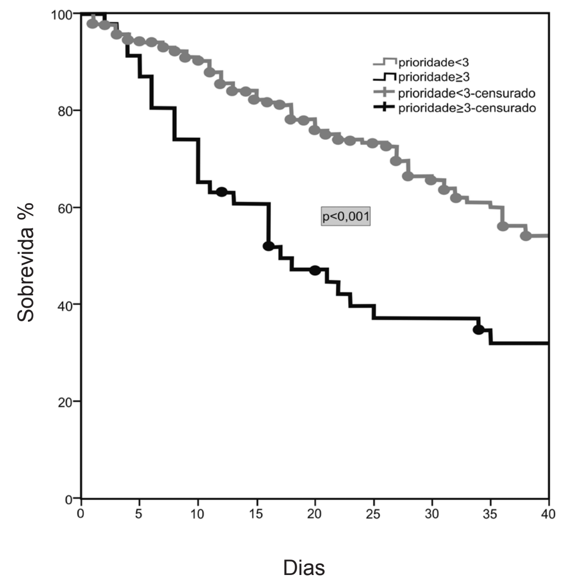


Figure 2 – Hospital survival curve for groups admitted to the ICU, log rank test $p<0.001$



the acute disease are better for predicting mortality in the ICU than age. In contrast, we must also not forget that the quality of life of these patients worsens after admission to the ICU[32-35].

One limitation, not just of this study but also of others related to the same subject, is that we investigated the tool applied to patients who had already been admitted into intensive care. We did not test a screening tool for admission to the ICU. Another limitation is the observational design, with the limitations that are inherent to this type of study.

CONCLUSIONS

In addition to being complex, decisions on refusing ICU admission to patients are also challenging. Age, the presence of comorbidities and prognostic and organ dysfunction scores were all greater in priority 3 and 4 patients, and were related with refusal to admit the patient to the ICU. Patients refused admission to the ICU exhibited an elevated mortality rate and this rate was also high among priority 3 and 4 patients even when they were admitted to the ICU. Therefore, objective criteria based on levels of priority appear to be effective for triage of patients in order to identify those will most benefit from intensive care support, thereby improving utilization of available resources.

Studies that examine objective criteria for admission and benefits of admission to ICUs should be encouraged, in order to better define appropriate resource utilization.

Conflicts of interest: none

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Artigo recebido: 23/10/09
Aceito para publicação: 31/05/10