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Analysis of Outcomes of Critically ill Surgical Patients using SAPS II Score

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ABSTRACT

Introduction
Several prognostic models have been implemented for risk assessment and mortality prediction in critically ill patients admitted in ICU. The availability of such sophisticated methods has facilitated in clinical decision making and comparison of outcomes. However, none are universally accepted as standard method to predict mortality. We have decided to use SAPS II score because of the simplicity and easy availability of its variables to analyse the outcomes of critically ill surgical patients admitted to ICU at our centre.

Methods
The study was conducted between September 2016 and August 2018 at Nepal Medical College and Teaching Hospital, Kathmandu, Nepal. We prospectively collected data on surgical patients consecutively admitted to the ICU during the study period. The variables of SAPS II score were collected from the physiological, laboratory, and patient characteristics mentioned in the ICU scoring data sheet at 24 hours. The SAPS II score and predicted mortality was calculated using computer software programme. The predictive mortality based on the score was compared with the actual outcome to derive the standardized mortality ratio (SMR).

Results
During the period of study, 64 patients met the inclusion criteria. The mean age of the patients was 54±17.9 (20-84) years and length of ICU stay was 5.3 ±3.5 (3-22) days. GI malignancy was most common pathology comprising 43.8% (n=28). The mean SAPS II score was 24.9±16.4 (3-68). There was no statistical difference in mean SAPS II score between patients with different gender, nature of disease and type of surgical intervention The mean predicted mortality was 13.4% and the observed ICU mortality was 15.6% (n=10). The calculated mean SAPS II score and predicted mortality was higher in nonsurvivors compared to survivors ($p<0.0001$). The calculated SMR for our study population was 0.85 ranging from 0.01 to 5.2. The number of patients with SMR greater than 1 was only 17 % (11/64). There was significant correlation of mortality with SMR greater than 1 (p=<0.0001).

Conclusion
The variables in SAPS II score are readily available. Neither special samples nor cumbersome procedures are required. SAPS II can be used as simple and rapid tool to predict mortality in critically ill surgical patients in our set up.

Keywords: *Critically ill, intensive care unit, mortality, outcome, SAPS II*

INTRODUCTION

Severity scoring systems are designed to evaluate and predict probability of hospital mortality among the critically ill patients.[1] Given the relatively higher mortality among Intensive Care Unit (ICU) patients, mortality is a sensitive appropriate and meaningful measure of outcome.[2] Several prognostic prediction models have been implemented in the intensive care unit (ICU) setting since the 1980s. However, there is paucity of universally accepted and standard method to correctly predict mortality even in well-established centres.[3] Plethora of newer system has been developed using sophisticated statistical techniques in large multinational databases and are found to perform better than their predecessors.[4] Different centres are utilising different scoring system to estimate probability of hospital mortality for critically ill patients due to various disease processes. The availability of such sophisticated methods for risk adjustment and mortality prediction have facilitated treating surgeons and physicians in clinical decision making, resource allocation and comparison of outcomes.[2,5]

Severity scores comprise usually two parts: the score itself and a probability model. The score itself is a number (the higest number, the highest severity). The probability model is an equation giving the probability of hospital death of the patients.[6] Scoring systems used in critically ill patients can be broadly divided into those that are specific for an organ or disease and those that are generic for all ICU patients. Generic scores are useful for assessment disease severity on admission and prediction of outcome.[7] Commonly used ICU prognostic scoring models include the Simplified Acute Physiologic Score II (SAPS II), Acute Physiology and Chronic Health Evaluation II (APACHE II), and the newly developed SAPS III.[8] Most of the scoring systems incorporate physiologic parameters, co morbidities, admitting diagnoses, Glasgow coma scales, and age to provide a numerical score that can in turn predict ICU mortality.[9] Irrespective of the dominance of one over another, no single method is reliable for predicting the mortality of surgical ICU patients.[10]

SAPS, developed and validated in France in 1984, used 13 weighted physiological variables and age to predict risk of death in ICU patients. SAPS was calculated from the worst values obtained during the first 24 hours of ICU admission.[6,11] The new Simplified Acute Physiology Score (SAPS II) was described in 1993 by Le Gall et al. This model includes 17 variables: 12 physiology variables (weighted according with their degree of deviation from normal value ranges); age; type of admission (medical and scheduled/unscheduled surgery); and three underlying diagnosis (acquired immunodeficiency syndrome, metastatic cancer and hematologic malignancy) chosen and weighed by logistic regression. The worst values for all variables are collected during the first 24 hours after admission to the ICU, their weights are summed and the final result is the SAPS II score. A logistic regression equation enables the conversion of the score into a probability of death in the hospital. [7-9,12]

Despite worldwide increment in the use of validated scoring systems, most centers of Nepal are underutilizing such predictive models. There have been no similar studies at our center to predict mortality and calculate the outcomes of patients admitted to ICU. Outcomes of patients admitted in ICU using various scores especially in terms of predicting mortality seems a beneficial approach. The outcomes could be compared with the outcomes of ICUs at other centres and the predicted mortality could guide towards better approach in management. We have decided to use SAPS II score because of the simplicity of its variables to analyse the outcomes of critically ill surgical patients admitted to ICU.

METHODS

The study was conducted between September 2016 and August 2018 at Nepal Medical College and Teaching Hospital, a tertiary care centre in Kathmandu, Nepal. The ICU is managed and run by a devoted team of anaesthesiologists and trained nursing staffs working in day and night shifts. An observational prospective cohort study was conducted after approval from Nepal Medical College Institutional Research/Ethical Sub-Committee (NMC-RESC). We prospectively collected data on surgical patients consecutively admitted to the ICU during the study period. Exclusion criteria were as follows: age less than 15 years, ICU stay less than 48 hours, burn, terminal cancer, do not resuscitate (DNR) and end-of-life care orders. The patients whose SAPS II score calculation was incomplete due to missing data were excluded from the study. Informed consent was obtained from competent patients or their representatives if they were incompetent. The variables of SAPS II score were collected from the physiological, laboratory, and patient characteristics mentioned in the ICU scoring data sheet at 24 hours. SAPS II score includes 17 variables and varies from zero to 163 points (up to 116 points for physiological variables, up to 17 points for age, and up to 30 points for chronic diagnosis). All patients who survived for at least 48 hours in the ICU were subsequently followed up till discharge from ward or mortality. All major events, as well as

Table.1. Patient Characteristics

Variables		Frequency	Percentage
Gender	Male	44	68.8
	Female	20	31.2
Clinical pathology	Malignancy	28	43.8
	Acute intestinal obstruction	14	21.9
	Bowel perforation	10	15.6
	Trauma	5	7.8
	Others	7	10.9
Comorbidities	Yes	24	37.5
	No	40	62.5
Outcome	Survivors	54	84.4
	Non-survivors	10	15.6

mortality following admission were recorded. The SAPS II score and predicted mortality was calculated using computer software programme. The predictive mortality based on the score was compared with the actual outcome to derive the standardized mortality ratio (SMR). The outcomes of the patient were finally classified as survivors and nonsurvivors. Microsoft Access 2007 software database was used for data storage (Microsoft Corporation, Redmond, WA, USA). The observations were compiled, tabulated, and analyzed statistically using SPSS, version 16.0 (SPSS Inc., Chicago, Illinois, USA). The Student,s t-test was used for analysis of continuous variables and the χ^2-test was used for analysis of categorical variables. The SMR was calculated by dividing observed hospital mortality by the predicted hospital mortality. The accuracy of outcome

Table .2. Comparison of mean SAPS score and patient characteristics

Variables		Mean SAPS	P value
Gender	Male	24.2±17.5	0.886
	Female	25.4±15.9	
Disease type	Benign	28.4±15.6	0.072
	Malignant	21±16.4	
Surgery type	Scheduled	25.2±17.5	0.937
	Non-scheduled	24.8±16.1	

Table. 3. Comparison of variables between survivors and non-survivors

Variables	Survivors	Non-survivors	P value
Age (years)	51.9±17.8	70.2±8.3	0.002
ICU LOS (days)	4.7±2.7	5.3±3.5	0.005
Mean SAPS Score	19.2±9.4	55.9±10.2	0.0001
Mean predicted mortality	5.1±5.2	57.8 ±22.2	0.0001

prediction by SAPS II system was assessed with Standarised Mortality Ratio (SMR).

RESULTS

During the period of study, 64 patients met the inclusion criteria. The mean age of the patients was 54±17.9 (20-84) years and length of ICU stay was 5.3 ±3.5 (3-22) days. Among the study population 44 patients (68.8%) were male. GI malignancy was most common pathology comprising 43.8% (n=28) followed by acute intestinal obstruction in 21.9% (n=14), bowel perforation in 15.6% (n=10), abdominal trauma in 7.8% (n=5) and others in 10.9% (n=7). Twenty four patients (37.5%) had systemic comorbid diseases. (Table 1)

The mean SAPS score was 24.9±16.4 (3-68). The mean SAPS score was comparable among male and female patients (p= 0.886). Similarly, the mean SAPS score did not differ with type of disease (benign or malignant) (p=0.072) and type of surgery (scheduled or non-scheduled) (p=0.937). (Table 2)

The mean predicted mortality was 13.4% and the observed ICU mortality was 15.6% (n=10). In comparison with the survivors, the nonsurvivors were older (P<0.002) and had longer stays in the ICU (P = 0.005). The calculated mean SAPS II score was higher in nonsurvivors compared to survivors (p<0.0001). Similarly, the predicted mortality was significantly higher in nonsurvivors compared with survivors. (Table 3)

There was no statistical difference between patients with different gender, nature of disease and type of surgical intervention. The

Table.4. Correlation of mortality

Variables		Non-survivors	Survivors	P value
Gender	Male	7	37	0.926
	Female	3	17	
Type disease	Benign	6	28	0.635
	Malignant	4	26	
Type of surgery	Scheduled	3	16	0.98
	Un scheduled	7	38	
Comorbid illness	Present	6	18	0.11
	Absent	4	36	
SMR	>1	8	3	0.0001
	<1	2	51	

calculated SMR for our study population was 0.85 ranging from 0.01 to 5.2. The number of patients with SMR greater than 1 was only 17 % (11/64). There was significant correlation of mortality with SMR greater than 1 (p=<0.0001). (Table 4)

DISCUSSION

Various simple as well as sophisticated severity scoring systems are available for estimation of the probability of mortality in ICU patients. Several criteria should be taken into consideration while selecting any scoring system in clinical practice. Reliability and validity are important issues that allow confident use of a scoring system in intensive care unit (ICU) patients with different baseline characteristics.[13] Customization and adding variables to the scoring system can largely improve performance.[14,15] We have applied SAPS II score in our study because it is simple and feasible system compared to other sophisticated soring systems.

In 2014, Sawicka W et al analysed 114 patients with hematological malignancies admitted to the ICU due to severe dysfunction of vital organs and systems. They used APACHE II, SAPS II and SOFA scores. Of all the applied patient assessment scales, only the SAPS II score was found to be useful. The SAPS II score was identified as the only independent risk factor for death.[16] Various studies have shown that most of the predictive models overestimate the mortality in the ICU patients. Strand et al. in 2009 carried out a prospective study to evaluate and compare the performance of SAPS II and SAPS III in a Norwegian intensive care unit (ICU) population. They found the newly developed SAPS III to overestimate mortality even more than the older SAPS II due to disparity related to recent changes in ICU organization and improvements in medical treatment.11 Mohammad et al used APACHE II and SAPS II to predict ICU mortality and found similar predicted probabilities of death (35% to 37%) with both models, while the actual mortality was even higher (42%). In their study, both models underestimated mortality.[17] The SAPS II score has underestimated the mortality in our study as the mean predicted mortality was 13.4 % and observed mortality was 15.6%.

In 1997, Schuster HP et al analysed a cohort of 1587 ICU patients to evaluate the applicability of the Simplified Acute Physiology Score (SAPS II). From the observations they concluded that SAPS II was suitable to describe severity of disease and prognosis in coronary care patients in medical intensive care unit.[18] Prakash P et al carried out study in 100 patients (above 12 years of age), who presented with respiratory failure and required mechanical ventilation. They concluded that SAPS II score provides reliable prediction of mortality without having to specify a primary diagnosis.[19] Our study population comprised of all patients admitted to ICU before or after major abdominal surgeries. The clinical diagnosis and indication for surgery mainly included abdominal trauma, bowel perforation or obstruction and gastrointestinal malignancies. The mean SAPS score did not differ with type of disease (benign or malignant) (p=0.072) and type of surgery (scheduled or non-scheduled) (p=0.937). Our study also revealed that there was no statistical difference in mortality among patients with type of diseases and type of surgery and presence or absence of comorbid illness.

In a prospective study, Lucena JF et al concluded that both the APACHE II and SAPS II scores over predicted mortality, SAPS II showed better discrimination for patients admitted to ICU in terms of Standardized mortality ratios (SMR).[20] Jean Roger at al conducted a study in French intensive units using SAPS II and reported the SMR range from 0.48 to 1.89 with 44% patients (43/97) having SMR greater than one.[21] The calculated SMR for our study population was 0.85 ranging from 0.01 to 5.2. The number of patients with SMR greater than one was only 17 % (11/64) and it was comparable to the predicted and observed mortality (13.4% and 15.6%). There was significant correlation of mortality with SMR greater than one (p=<0.0001). SMR is a very good aspect of evaluation of ICU performances but other aspects of performances like patient and family satisfaction, costs and organizational issues also need consideration.

Mortality and outcome of ICU patients depends on various patient and disease related factors. Moreover, some technical and surgeon related factors also play significant role in outcome of patients after major surgeries. Our study revealed no difference in mortality between male and female. In comparison with the survivors, the non-survivors were older (P<0.002) and had longer stays in the ICU (P = 0.005). The calculated mean SAPS II and the predicted mortality was significantly higher in nonsurvivors compared with survivors. Hence, SAPS II was helpful in identifying the ICU population at high risk for mortality.

CONCLUSION

Mortality is an appropriate, meaningful and reliable measure of outcome in critically ill patients admitted in Intensive Care Unit. SAPS II can be used as simple and rapid tool to predict mortality in critically ill surgical patients. The variables in SAPS II score are relatively simple and readily available. SAPS II scores is significant predictor of mortality of surgical patients admitted to the ICU. Calculation of SMR adds to the accuracy and reliability of SAPS II score in measuring mortality.

CONFLICTS OF INTEREST

None declared.

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