Validez de APACHE II y SAPS II como predictores de mortalidad precoz y a los 3 meses en pacientes con sepsis

Validity of APACHE II and SAPS II scores as predictors of early global mortality at 3 months from sepsis

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ABSTRACT

Background: Acute Physiology and Chronic Health Evaluation (APACHE) II and Simplified Acute Physiology Score (SAPS) II have become a necessary tool to describe intensive care unit (ICU) patients and to predict differences in mortality. Both are calculated in the first 24 hours of hospitalization, in which higher levels correspond to more serious diseases and a higher risk of death. Sepsis is a major cause of morbidity in ICU, it is estimated that about half of the patients have a healthcare-associated infection and are, therefore, at a higher risk of death. This study aims to determine the comparative efficacy of different scoring system (APACHE II and SAPS II scores) in assessing the prognosis of critically ill patients that were admitted to the ICU by sepsis in a tertiary hospital and compare them for prediction of the outcome in these patients in early mortality (up to 3 months).

Methods: We performed a retrospective review of five hundred and thirty three patients admitted to the ICU from January 2018 to December 2019. We included all patients (medical or surgical patients) over the age 16 years old, and we selected those with the first diagnosis of "sepsis". Patient selection and data collection were obtained through medical records. Predicted mortality was calculated using APACHE II and SAPS II and also the early mortality. Group comparisons between survivors and non-survivors from sepsis were performed using the Student-T test to compare continuous with categorical variables and chi square test for categorical variables. Pearson's correlation was used to compare two continuous variables Statistical analysis was performed using SPSS software version 27.0 (IBM, Armonk, NY, USA).

Results: Out of 533 patients, 71 had sepsis (13%). Of these 71 patients, 36 (50.7%) died during the 3 month follow-up. Average APACHE II and SAPS II scores in all patients were 23.5 ± 8.1 (p=0.02) and 52.9 ± 17.7 respectively, and they were significantly different between survivors and non-survivors. A statistically significant positive correlation was established between the values of SAPS II and APACHE II (r=0.76; p<0.01). By the examination of validity and classification accuracy by ROC curve, we conclude that: SAPS II had AUC > 0.662 and APACHE II had AUC > 0.639. Both can predict the risk of mortality in these patients, but SAPS II seems to be slightly more accurate. We also observed that elderly patients were expected to have a worse prognosis. The average age of survivors was 64.5 ± 13.8 years and for non-survivors 75.2 ± 8.8 years (p<0.01).

Conclusion: Both APACHE and SAPS II are accurate tools to describe and predict mortality caused by sepsis. There was no significant difference in the clinical values of SAPS II and APACHE II and taking in consideration the high correlation between both, only one, could be enough to make a mortality prediction.

Keywords: APACHE II; mortality; SAPS II; sepsis

INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a deregulated host response to infection and is one of the leading causes of in-hospital mortality and morbidity among medical and surgical patients[1,2].

Sepsis and septic shock are a major cause of morbidity and mortality in modern ICUs admissions and the leading causes of mortality in non-coronary ICUs[2]. The epidemiology of severe sepsis and septic shock has been difficult to determine because of an inconsistent approach to definitions and diagnosis[3,4].

There is a lack of an agreed severity of illness scoring system for patients with sepsis. In the absence of such a system, it is difficult to interpret sepsis outcome studies[2,4]. Mortality Prediction Systems have been introduced as tools for assessing the performance of ICUs[1,4]. These systems help in individual patient outcome prediction, reducing uncertainty and providing an opportunity for improved decision making. Prognostic scoring systems can facilitate quality assessment of an individual ICU, allowing comparison of its overall performance to a large scale representative database.

APACHE and SAPS are the most used scoring systems. Among those, APACHE II and SAPS II are used more often by the majority of ICUs to forecast the clinical consequence.

APACHE II was introduced in 1985. This system generates a point rating that varies between 0 and 71, based on 12 physiological variables, age and underlying health[5]. The APACHE III system was developed in 1991 and the APACHE IV system in 2006[5,6]. These systems are more complex, have a greater number of physiological variables, but are a little more intricate and, therefore, less used.

On the other hand, SAPS is a model developed in France By Le Gall et al. in 1983, modified for SAPS II in 1993[6]. It consists of 12 physiological variables, age, type of admission and presence of chronic disease[7].

The aim of this study was to assess the performance of APACHE II and SAPS II scoring methods in forecasting death among critically ill patients admitted by sepsis to the intensive care unit (ICU) of a Tertiary Care Hospital.

MATERIAL AND METHODS

A retrospective, observational single centre analysis was performed in the ICU in a tertiary care hospital in Portugal from January 2018 to December 2019.

Data was collected from clinical records and all patients admitted to critical unit in the past 2 years were included. After reviewing clinical notes, patients were excluded if primary diagnosis was not sepsis. APACHE II and SAPS II were calculated in all patients.

The study protocol is according to the Declaration of Helsinki. The collection of clinical information for this study was approved by our hospital institutional review board.

Statistical analysis

Patient selection and data collection were obtained through medical records. The predictive mortality was calculated by APACHE II and SAPS II as well as the early mortality. Group comparisons between survivors and non-survivors from sepsis were performed using the Student-T test to compare continuous with categorical variables and chi square test for categorical variables. Pearson's correlation was used to compare two continuous variables. A p-value less than 0,05 was considered significant. Statistical analysis was performed using SPSS software version 27.0 (IBM, Armonk, NY, USA).

RESULTS

In the last 2 years, 533 patients were admitted in the critical care unit. 462 were excluded since sepsis was not primary diagnosis.

Seventy-one (13.32%) were diagnosed with sepsis. However, thirty six (50.7%) died up to 3 months by sepsis. Mean age was 69.5 years (±12,8) and thirty six (50.7%) were women. Baseline characteristics are presented in Table 1. From the 71 patients included 36 died up to 3 months.

Mean APACHE II and SAPS II scores in all patients were significantly different between survivors and non-survivors (APACHE 21.5±7.3 vs 25.8± 8.6, p 0.02 and SAPS II 47.6±14.7 vs 59.1±19.1, p 0.01).

Receiver operating characteristic (ROC) and the areas under the curve (AUC) curves were calculated to evaluate the predictive capacity of the severity scores and to assess the predictive value of mortality of both scores (discrimination), with their 95% confidence interval.

A statistically significant positive correlation was established between the values of SAPS II and APACHE II. A statistically significant positive correlation was established between the values of SAPS II and APACHE II (r=0.76; p<0.01), using the Pearson correlation coefficient, figure 1.

Figure 1. Simple Scatter with Fit Line of saps2 bu apache
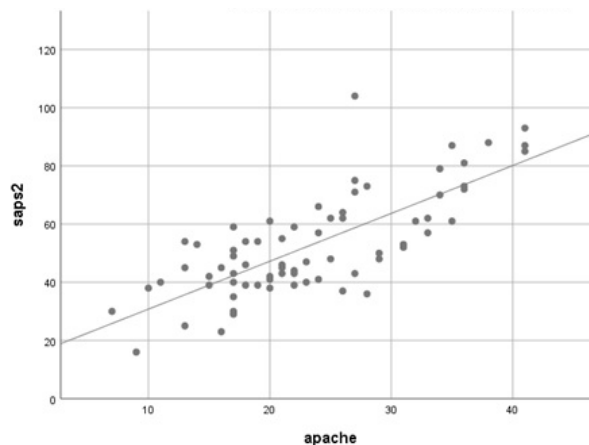
By the examination of validity and classification accuracy by ROC curve, we conclude that: SAPS II had AUC > 0.662 and APACHE II had AUC > 0.639, table 2. Both can predict the risk of mortality in these patients, but SAPS II seems to be slightly more accurate, figure 2, 3 and 4, and table 2.

We also observed that elderly patients were expected to have a worse prognosis. The average age of survivors was 64.5 ± 13.8 years and for non-survivors 75.2 ± 8.8 years (p<0.01), table 1.

Table 1.

	Total (n=71)	Survivors (3m) (n=35)	Non- Survivors (3m) (n=36)	*p*-value	IC
Age, average (dp)	69.5 (±12.8)	64.5 (±13.8)	75.2 (±8.8)	<0.01	[5.2-1-16.1,]
Women, n (%)	36 (50.7)	25 (65.8)	11 (33.3)	0.01	
APACHE, average (dp)	23.5 (±8.1)	21.5 (±7.3)	25.8 (±8.6)	0.02	[0.6-8.2]
SAPS2, average (dp)	52.9 (±17.7)	47.6 (±14.7)	59.1 (±19.1)	<0.01	[3.5-19.6]

Table 2.

Area Under the Curve					
				Asymptotic 95% Confidence Interval	
Test Result Variable(s)	Area	Std. Error[a]	Asymptotic Sig.[b]	Lower Bound	Upper Bound
SAPS II	.662	.064	.019	.536	.788
APACHE II	.639	.067	.044	.508	.770

Figure 2.

1-Sprecificity
Diagonal segments are produced by ties

Figure 3.

1-Sprecificity
Diagonal segments are produced by ties

Figure 4.

1-Sprecificity
Diagonal segments are produced by ties
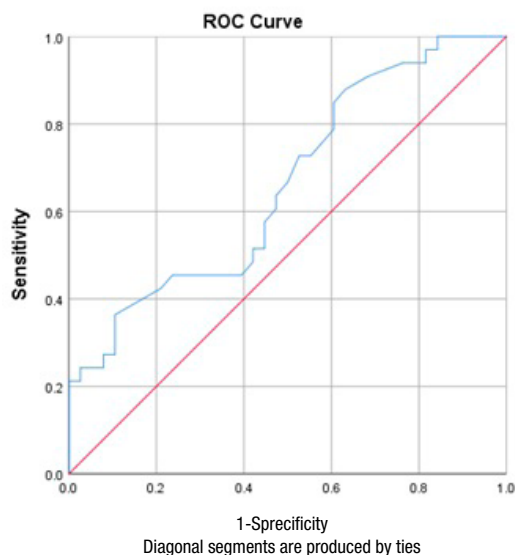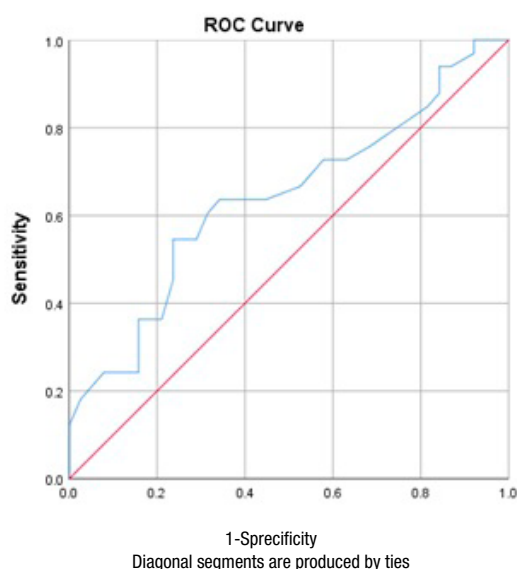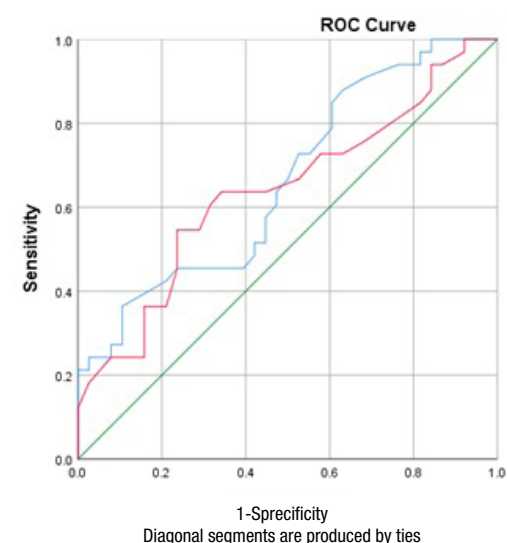
Source of the Curve
— saps2
— apache
— Reference Line

DISCUSSION

Scoring systems in the ICU have become an important tool for measuring the performance of the ICU[6,7]. Theoretically, the ideal score should be able to predict the outcome of the patient on admission to the ICU however this score has not yet been developed. Countless prognostic scores have been developed and have been proposed for use in ICU patients[5].

To our knowledge this is the first Portuguese analysis that compares both scores and demonstrates which one is better to predict the early mortality.

This means that there is a good correlation between these two variables when it comes to quantifying the severity of the disease and assessing its prognosis.

The analyzed scores did not have a good ability to discriminate against mortality, that is, they underestimated mortality in the ICU (AUROC <0.70). Le Gall et al. (1993), in the original SAPS II study, obtained AUROC of 0.823 proving the best prediction of score mortality[8,9]. At the same time, Mcnelis et al. (2001), state that SAPS II can overestimate mortality in elderly patients and chronically ill[10].

The current study demonstrated that both APACHE and SAPS II were accurate tools to describe and predicted mortality caused by sepsis. There was no significant difference in the clinical values of SAPS II and APACHE II and taking in consideration the high correlation between both, only one, could be enough to make a mortality prediction.

Some limitations to this study should be noted. This is an observational, single centre study with a small number of patients and retrospectively collected data.

The admitted patients were elderly patients which increase the mortality rate. They are people with a lower rate of physiological reserve, not surviving sepsis as easily. Many of them already have an organ dysfunction (chronic diseases). It was then admitted that the 36 patients who died of sepsis would already have a low physiological reserve.

More studies are needed with a sample of not so old patients.

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