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Brief communication

Does SOFA predict outcomes better than SIRS in Brazilian ICU patients with suspected infection? A retrospective cohort study

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ABSTRACT

We compared the discriminatory capacity of the sequential organ failure assessment (SOFA) versus the systemic inflammatory response syndrome (SIRS) score for predicting ICU mortality, need for and length of mechanical ventilation (MV), ICU stay, and hospitalization in patients with suspected infection admitted to a mixed Brazilian ICU. We performed a retrospective analysis of a longitudinal ICU database from a tertiary hospital in Southern Brazil. Patients were categorized according to whether they met the criteria for sepsis according to SOFA (variation ≥ 2 points over the baseline clinical condition) and SIRS (SIRS score ≥ 2 points). From January 2008 to December 2014, 1487 patients were admitted to the ICU due to suspected infection. SOFA ≥ 2 identified more septic patients than SIRS ≥ 2 (79.0% [$n = 1175$] vs. 68.5% [$n = 1020$], $p < 0.001$). There was no difference between the two scores in predicting ICU mortality (area under the receiver operating characteristic curve (AUROC) = 0.64 vs. 0.64, $p = 0.99$). SOFA ≥ 2 was marginally better than SIRS ≥ 2 in predicting need for MV (AUROC = 0.64 vs. 0.62, $p = 0.001$), ICU stay > 7 days (AUROC = 0.65 vs. 0.63, $p = 0.004$), and length of hospitalization > 10 days (AUROC = 0.61 vs. 0.59, $p < 0.001$). There was no difference between the two scores in predicting MV > 7 days.

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Sepsis results in significant mortality,¹⁻³ morbidity, and resource utilization during and after critical illnesses.⁴

The previous consensus definitions of Sepsis (Sepsis-1 and Sepsis-2)^{5,6} relied on the systemic inflammatory response syn-

drome (SIRS) to infection as a fundamental aspect of sepsis diagnosis. In 2016, the Sepsis-3 definition changed the focus from the presence of infection-related SIRS to the presence of infection-related organ dysfunction.⁷ The new consensus was mainly supported by the retrospective study by Seymour et al.,⁸ which showed that sequential organ failure assessment (SOFA) resulted in better predictive accuracy for mortality than SIRS among US and European ICU patients.

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37 However, some health care societies⁹ and experts¹⁰ have
38 expressed disappointment with the new recommendations,
39 mainly due to the lack of studies on the performance of the
40 organ dysfunction scores in developing countries. Thus, to
41 safely adopt the new criteria proposed by Sepsis-3 in a broader
42 context, it is necessary to validate it in scenarios different
43 from those originally tested. In addition, other outcomes rele-
44 vant to critical care patients besides death should be assessed.
45 Therefore, we aimed to compare the discriminatory capacity
46 of SOFA versus SIRS for predicting relevant outcomes among
47 adult patients admitted to a mixed intensive care unit (ICU) of
48 a tertiary hospital in Southern Brazil due to suspected infec-
49 tion.

50 We performed a retrospective analysis of a comprehensive
51 prospectively collected longitudinal ICU database composed
52 of 4221 patients admitted to the 31-bed mixed ICU of Hospital
53 Moinhos de Vento, Porto Alegre, Brazil, over a 7-year period
54 (January 2008 to December 2014). This study was approved by
55 the Research Ethics Committee at Hospital Moinhos de Vento.
56 The need for informed consent was waived. All patients with
57 suspected infections at ICU admission were considered eligi-
58 ble for the study. Patients were identified using infection, sepsis,
59 severe sepsis, septic shock, pneumonia, urinary tract infection, blood-
60 stream infection, intra-abdominal infection, central nervous system
61 infection, osteoarticular infection, and skin and soft tissue infec-
62 tion as search terms in the syndromic diagnosis field of the
63 database.

64 The exposure variables were diagnosis of sepsis according
65 to SOFA and SIRS definitions at ICU admission. Patients were
66 classified as having sepsis according to SOFA if they had a
67 score variation ≥ 2 points over the baseline clinical condition.⁷
68 The SOFA was assumed to be zero in patients not known to
69 have preexisting organ dysfunction. In patients with chronic
70 organ dysfunction, the baseline SOFA was assumed to be 4 in
71 patients undergoing chronic renal replacement therapy, and 2
72 or 4 in patients with cirrhosis, depending on baseline bilirubin
73 levels. Patients were classified as having sepsis according
74 to SIRS if they presented at least two of the following signs
75 of systemic inflammation: temperature $> 38^\circ\text{C}$ or $< 36^\circ\text{C}$, heart
76 rate > 90 beats per minute, respiratory rate > 20 breaths per
77 minute or $\text{PaCO}_2 < 32$ mmHg, abnormal white blood cell count
78 ($> 12,000/\mu\text{L}$ or $< 4000/\mu\text{L}$ or $> 10\%$ immature forms).⁵ In order to
79 evaluate the prognosis of patients according to the presence
80 or absence of organ dysfunction (SOFA variation ≥ 2 points
81 over the baseline clinical condition) and SIRS (SIRS score ≥ 2
82 points) we created four groups: (1) patients with organ dys-
83 function and SIRS; (2) patients with SIRS but without organ
84 dysfunction; (3) patients with organ dysfunction but without
85 SIRS; and (4) patients with infection, but with neither SIRS nor
86 organ dysfunction.

87 The outcomes evaluated were all-cause ICU mortality, need
88 and length of for invasive mechanical ventilation (MV), length
89 of ICU stay, and length of hospitalization. Prolonged MV, ICU
90 stay, and hospitalization were defined as duration of these
91 variables above the 75th percentile of the studied population.
92 The accuracy of the different sepsis definitions for predict-
93 ing these outcomes was evaluated through the area under the
94 receiver operating characteristic (ROC) curve (AUROC). Uni-
95 variate modeling of the two definitions was compared using

96 the Chi-squared test. A comparison of outcomes among the
97 study groups was made using the Kruskal–Wallis test for
98 continuous variables and the Pearson's Chi-squared test for
99 dichotomous variables. Among post hoc tests, Dunn's test
100 was applied after the Kruskal–Wallis test, and Bonferroni cor-
101 rection was applied after the Pearson's Chi-squared test. A
102 significance level of 0.05 was adopted for all comparisons.
103 Stata v. 12 (StataCorp LP, College Station, TX, USA) was used
104 for statistical analysis.

105 SOFA ≥ 2 identified a higher number of septic patients in
106 comparison to the SIRS ≥ 2 (79.0% [$n = 1175$] vs. 68.5% [$n = 1020$],
107 $p < 0.001$). Baseline characteristics of patients according to the
108 different definitions of sepsis were comparable. There were
109 no statistical differences in the proportion of males (SOFA
110 ≥ 2 , 55.6% vs. SIRS ≥ 2 , 54.0%), median age (SOFA ≥ 2 , 75.0
111 [interquartile range {IQR}, 63.0–83.0] vs. SIRS ≥ 2 , 75.0 [IQR,
112 63.0–83.0]), median number of comorbidities (SOFA ≥ 2 , 3.0
113 [IQR, 2.0–4.0] vs. SIRS ≥ 2 , 3.0 [IQR, 2.0–4.0]), median APACHE-
114 II score at ICU admission (SOFA ≥ 2 , 21.0 [IQR, 16.0–25.0] vs.
115 SIRS ≥ 2 , 21.0 [IQR, 16.0–26.0]), and median SOFA score at ICU
116 admission (SOFA ≥ 2 , 5.0 [IQR, 3.0–8.0] vs. SIRS ≥ 2 : 5.0 [IQR,
117 3.0–8.0]).

118 A comparison of the predictive accuracy for the study out-
119 comes between SOFA ≥ 2 and SIRS ≥ 2 is shown in Fig. 1. SOFA
120 ≥ 2 and SIRS ≥ 2 showed similar discriminatory capacity for ICU
121 mortality (AUROC 0.64 [0.62–0.67] vs. 0.64 [0.62–0.67], $p = 0.99$).
122 SOFA ≥ 2 had a marginally better discriminatory capacity than
123 SIRS ≥ 2 for need for MV (AUROC 0.64 [95% CI, 0.62–0.65] vs.
124 0.62 [95% CI, 0.61–0.63], $p = 0.001$), length of ICU stay > 7 days
125 (AUROC 0.65 [95% CI, 0.63–0.66] vs. 0.63 [95% CI, 0.62–0.64],
126 $p = 0.004$), and length of hospitalization > 10 days (AUROC 0.61
127 [95% CI, 0.60–0.63] vs. 0.59 [95% CI, 0.58–0.61], $p < 0.001$). There
128 was no difference between the scores in terms of the predict-
129 ing length of MV > 7 days.

130 Table 1 shows a comparison of the outcomes according
131 to the presence or absence of organ dysfunction and SIRS.
132 Patients with both organ dysfunction and SIRS had worst
133 outcomes compared to patients of other groups: higher ICU
134 mortality, higher need of MV, and longer ICU stay. The com-
135 parison of outcomes among patients with SIRS but without
136 organ dysfunction and patients with organ dysfunction but
137 without SIRS showed no statistical difference. Patients with
138 neither organ dysfunction nor SIRS had better outcomes: lower
139 rates of mortality and MV and shorter length of ICU stay in
140 comparison to patients from other groups.

141 In this study constituted of Brazilian critical care patients
142 with suspected infections who were admitted to a mixed
143 medical-surgical ICU, the SOFA ≥ 2 criteria identified more
144 patients with sepsis than the SIRS ≥ 2 criteria. There was no
145 difference between the two scores in predicting ICU mortal-
146 ity; however, SOFA ≥ 2 showed a marginally better predictive
147 accuracy for need for MV, length of ICU stay, and length of
148 hospitalization in comparison to the SIRS ≥ 2 definition. The
149 prognosis of patients classified as having sepsis by SOFA ≥ 2
150 but not by SIRS ≥ 2 ($n = 308$), was generally poorer than the
151 prognosis of patients with infection but without SIRS or organ
152 dysfunction. Conversely, some patients previously classified
153 as having sepsis by SIRS ≥ 2 were not captured by the SOFA ≥ 2
154 criteria ($n = 153$), and these patients also had poorer prognosis

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