

# Diagnostic Accuracy of Sequential Organ Failure Assessment Score In Predicting Mortality In Patients With Acute Pancreatitis

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## ABSTRACT

**Objective** To determine the diagnostic accuracy of sequential organ failure assessment (SOFA) score in predicting the early mortality of acute pancreatitis.

**Study design** Cross-sectional study.

**Place & Duration of study** Department of Surgery, Dr. Ruth K.M. Pfau Civil Hospital Karachi, from November 2020 to May 2021

**Methodology** Total of 146 patients were included in the study. SOFA score >7 was used to predict the mortality. Descriptive statistics were used for data analysis. Post stratification Chi-square test was applied. A p value of <0.05 was considered significant. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy were calculated for SOFA score at admission and day 7 for predicting mortality of acute pancreatitis at day-28.

**Results** There were 81(55.5%) male and 65(44.5%) female patients. The mortality in this study was 19.2%. Sensitivity, specificity, PPV, NPV and accuracy of SOFA score at admission were 78.57%, 95.76%, 81.48%, 94.95%, and 92.72% as compared to SOFA score on day 7; 96.42%, 100%, 100%, 99.15% and 99.31% respectively in predicting mortality in acute pancreatitis.

**Conclusion** Higher sensitivity, specificity, and diagnostic accuracy of SOFA score in predicting mortality in acute pancreatitis was on day 7 as compared to SOFA score at admission.

**Key words** Diagnostic accuracy, SOFA score, Acute pancreatitis, Mortality.

## INTRODUCTION:

Acute pancreatitis is an acute surgical emergency with high morbidity and mortality. The incidence of this condition is on rise.<sup>1</sup> An accurate diagnosis, severity assessment and prognostic indices are essential in the management of this condition.<sup>2-4</sup> An

ideal tool is required which is easy to apply, being valid and reproducible.<sup>5</sup>

The clinical course of acute pancreatitis occurs in two phases: early and late. The early phase lasting up to seven days is dependent on the host response to cytokine release and its systemic manifestations such as systemic inflammatory response syndrome (SIRS) and compensatory anti-inflammatory response syndrome (CARS), predisposing infections.<sup>6</sup> Late phase is characterized by systemic signs of ongoing inflammation, local and systemic complications. Nearly 50% of mortality occurs early (within two weeks), secondary to multiple organ dysfunction syndrome (MODS).<sup>7</sup> Identification of patients with severe disease, requiring early aggressive resuscitation and close monitoring along-with timely

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interventions is crucial.<sup>8</sup>

The sequential organ failure assessment (SOFA) score is used for dynamic evaluation of degree of organ dysfunction. This SOFA scoring method provides the advantages of being objective, reliable, and reproducible for data collection.<sup>9</sup> The accuracy of repeated recordings of SOFA scores in patients with severe acute pancreatitis was assessed and a score on day-7 of admission is valid for predicting late mortality and overall mortality in patients with acute pancreatitis.<sup>10</sup> The rationale of this study was to ascertain diagnostic accuracy of SOFA score predicting mortality in patients with acute pancreatitis.

#### METHODOLOGY:

This cross-sectional study was conducted in the Department of General Surgery, Dr. Ruth K.M. Pfau Civil Hospital Karachi from November 2020 to May 2021 to determine the diagnostic accuracy at day-7 SOFA score in predicting the 28-day mortality of acute pancreatitis. Diagnostic accuracy was measured in terms of sensitivity, specificity, PPV and NPV, comparing survivors versus non survivors by taking true positive, true negative, false positive and false negative on SOFA scores. The sample size was 146, calculated by Buderer formula for sensitivity and specificity studies using confidence interval of 95%, sensitivity 88%, specificity 86%, desired precision of 12% and mortality rate of 20%. With consecutive sampling the inclusion criteria were diagnosis of pancreatitis, any gender, age 20-60 years, admitted via emergency department. Patients with history of chronic pancreatitis, traumatic pancreatitis, iatrogenic pancreatitis, pancreatic abscess, and those with early mortality within 7 days of admission, were excluded. Written and informed consent was obtained.

A SOFA score, comprising parameters related to 6-organ systems was calculated at the time of admission. Supportive treatment commenced and

subsequently SOFA score recorded on 7<sup>th</sup> post-admission day. A cutoff SOFA score >7 was used to predict the mortality in this study and all patients were followed till 28<sup>th</sup> post-admission day to evaluate the survivors or non-survivors. Final outcome (diagnostic accuracy) was then recorded.

The data were collected on a predesigned form with demographic information, etiology of acute pancreatitis, SOFA score at the time of admission and 7<sup>th</sup> post-admission day, and outcome. Data analysis were done using SPSS for Windows (version 23); Mean + standard deviation (SD) was computed for numerical variables like age distribution and SOFA scores. Categorical variables such as gender distribution and etiology of acute pancreatitis were reported as frequency and percentages. Sensitivity, specificity, PPV, NPV and diagnostic accuracy were calculated for survivors or non-survivors. Stratification was done with regards to etiology of pancreatitis in order to demonstrate the effect on outcomes through diagnostic accuracy. A p-value <0.05 was taken as statistically significant.

#### RESULTS:

A total of 146 patients were included in this study. There were 81(55.5%) male and 65 (44.5%) female patients. Mean age was 37.55±11.06 years. Gallstone was the most common cause of acute pancreatitis. Overall mortality in acute pancreatitis was 19.2%. Duration of admission and the details of frequency distribution are presented in table I.

The overall mean SOFA score on admission and 7th day were 5.34±2.7 and 3.60±6.43 respectively. In this study the diagnostic accuracy of SOFA score at admission in predicting mortality of acute pancreatitis was 92.71% as compared to 99.31% on day-7. SOFA score on admission and day-7, the sensitivity, specificity, PPV, NPV and accuracy are shown in table II and III.

**Table I: Demographic and Clinical Details**

Characteristics	
Mean Age	37.55±11.06 years
Male	81(55.5%)
Female	65(44.5%)
Cause of Acute Pancreatitis	
Gallstone Pancreatitis	127 (86.98%)
Alcohol Use	15 (10.29%)
Idiopathic	4 (2.73%)
Mean Length of Hospital Stay	10.46±2.87 days

**Table II: Diagnostic Accuracy of SOFA Score at admission for Predicting Mortality in Acute Pancreatitis**

Overall	Mortality			P-value
<b>SOFA Score at Admission</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	
>7	22 (78.6%)	5 (4.2%)	27	
<7	6 (21.4%)	113 (95.8)	119	0.000 *
Total	28	118	146	
<b>Sensitivity</b>	<b>Specificity</b>	<b>PPV</b>	<b>NPV</b>	<b>Accuracy</b>
77.77%	95%	80.76%	94.05%	91.33%
<b>Acute Gallstone Pancreatitis</b>				
	<b>Mortality</b>			<b>P-value</b>
<b>SOFA Score Admission</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	
>7	21 (77.8%)	5 (5%)	26	0.000*
<7	6 (22.2%)	95 (95%)	101	
Total	27	100	127	
<b>Sensitivity</b>	<b>Specificity</b>	<b>PPV</b>	<b>NPV</b>	<b>Accuracy</b>
77.77%	95%	80.76%	94.05%	91.33%
<b>Acute Alcoholic Pancreatitis</b>				
	<b>Mortality</b>			<b>P-value</b>
<b>SOFA Score Admission</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	
>7	1 (100)	0 (0)	1	
<7	0 (0)	14 (100%)	14	0.067
Total	1	14	15	
<b>Sensitivity</b>	<b>Specificity</b>	<b>PPV</b>	<b>NPV</b>	<b>Accuracy</b>
100%	100%	100%	100%	100%

**DISCUSSION:**

SOFA as means of patient stratification in management of acute pancreatitis is now being employed around the world, among other described scoring systems such as Ranson criteria, APACHE II, etc.<sup>11</sup> In this study we observed that SOFA score can be used as a reliable and reproducible scoring system to stratify risk of mortality at admission, but it has higher sensitivity and specificity when re-evaluated at day 7 for prediction of mortality. In our study of 146 patients, 28 (19.2%) died. Mortality in acute pancreatitis is directly linked to severity of disease and it can be as high as 30% in severe acute pancreatitis.<sup>10</sup> In a study of 238 patients relating biological prognostic factors to mortality in acute pancreatitis, overall mortality rate was 21.1%, which is comparable to our study.<sup>12</sup> Gallstone disease was found to be the most frequent cause (86.98%), whereas alcohol consumption (10.29%) was second most common etiology. In gallstone pancreatitis majority of the patients were female while in alcohol related acute pancreatitis most of them were male.

In a retrospective review of 653 patients with acute

pancreatitis, APACHE II, SOFA score, BISAP, Ranson, Glasgow and HAPS (Harmless Acute Pancreatitis Score) scores were compared. SOFA score was associated with highest specificity in predicting severe acute pancreatitis (SAP), ICU admissions and mortality at 99.7%, 99.2% and 98.9% respectively. It was observed that SOFA score in comparison to other scores demonstrated highest positive predictive value, positive likelihood ratio, diagnostic odds ratio and overall accuracy in predicting SAP, ICU admission and mortality.<sup>13</sup> In a cohort of 146 patients admitted with acute pancreatitis on cumulating severity scores for predicting adverse outcome in terms of mortality and need for admission in critical care units, SOFA score with cut off value > 5 was observed to be accurate in predicting adverse outcomes compared to other scores with odd ratio 32.00.<sup>14</sup> In this study we used cut off value of 7.

In a recent analysis, SOFA score proved to be the best indicator for predicting mortality in patients with severe acute pancreatitis; at the time of admission, day 2, 7, 14 and 21. A rising or declining trend on

**Table III: Diagnostic Accuracy of SOFA Score at Day-7 for Predicting Mortality in Acute Pancreatitis**

Overall	Mortality			P-value
<b>SOFA Score at 7 Days</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	
>7	27 (96.40%)	0 (0%)	27	<0.001 *
<7	1 (3.60%)	118 (100%)	119	
Total	28	118	146	
<b>Sensitivity</b>	<b>Specificity</b>	<b>PPV</b>	<b>NPV</b>	<b>Accuracy</b>
96.42%	100%	100%	99.15%	99.31%
<b>Acute Gallstone Pancreatitis</b>		<b>Mortality</b>		<b>P-value</b>
<b>SOFA Score at Day-7</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	
>7	26 (96.3%)	0 (0)	26	<0.001*
<7	1 (3.7%)	100 (100%)	101	
Total	27	100	127	
<b>Sensitivity</b>	<b>Specificity</b>	<b>PPV</b>	<b>NPV</b>	<b>Accuracy</b>
96.29%	100%	100%	99%	99.21%
<b>Acute Alcoholic Pancreatitis</b>		<b>Mortality</b>		<b>P-value</b>
<b>SOFA Score at Day-7</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	
>7	1 (100)	0 (0)	1	0.067
<7	0 (0)	14 (100%)	14	
Total	1	14	15	
<b>Sensitivity</b>	<b>Specificity</b>	<b>PPV</b>	<b>NPV</b>	<b>Accuracy</b>
100%	100%	100%	100%	100%

\*p-value <0.05 denotes statistical significance

repeated scores were concluded to be more reliable in predicting mortality.<sup>10</sup> Currently, SOFA score cutoff value has not been established in relation to mortality, and the acceptable discriminant point varies across studies (4-11).<sup>14,15</sup> In this study, SOFA score cutoff point was set at 7, which is within range (4-11) and requires further validation by independent cohorts. SOFA score provided additional prognostic information in patients with acute pancreatitis at admission and on day 7, for re-stratification of the disease process as mentioned in other study.<sup>10</sup> Though studied in limited patient population in our study, high SOFA scores were related to poor survival outcomes.

#### CONCLUSION:

The findings of this study showed higher sensitivity, specificity, and diagnostic accuracy of SOFA score on day 7 in predicting mortality in acute pancreatitis as compared to admission day. Day 7 is reliable time to re-evaluate the patient for risk stratification. SOFA score is helpful in identifying patients at risk of mortality.

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