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Short Communication

High Time for Including Gastrointestinal Injury Score in the Sofa Score

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Abstract:

The Sequential Organ Failure Assessment (SOFA) score, widely used in intensive care units (ICU), assesses six organ systems and predicts the severity of organ dysfunction and mortality. Intensivists are aware of the fact that acute gastrointestinal (AGI) injury is common among critically ill patients. However, the assessment of gastrointestinal injury is often neglected, and the AGI score has yet to be included in the SOFA score, unlike the six other organ dysfunctions. We discussed how there is ample literature to prove that the mortality prediction of SOFA improves when the AGI score is incorporated into it. Several available AGI scoring systems with pros and cons are also discussed.

Further, we analyzed the possible reasons for not integrating GI injury scores into SOFA and discussed how these reasons are no longer valid. We provided the rationale for including the GI injury score in the SOFA score. Thus, we emphasized that a scoring system that assesses gastrointestinal dysfunction is mandatory and should be incorporated into the widely used SOFA score to predict better the mortality of critically ill patients and other advantages.

Introduction

It is estimated that more than half of critically ill patients demonstrate varying degrees of acute gastrointestinal (GI) dysfunction, which adversely affects the prognosis. The clinicians often ignore the symptoms except in very severe cases. The SOFA score assesses six organ systems to calculate a total score, which reflects the severity of organ dysfunction, and the cumulative score is used to predict the risk of mortality. Intensivists worldwide are eager for a sepsis predictive model, and researchers are engaged in improving the reliability of patient outcomes based on various scores.

Although it is a known fact that acute gastrointestinal (GI) injury commonly afflicts critically ill patients, the score of GI injury/dysfunction had eluded inclusion in the SOFA score. We examine the incidence of GI injury, possible reasons for its non-inclusion in SOFA score, evidence of improvement of the predictability of SOFA when GI injury score is integrated into it, various grading of GI dysfunction and the compelling reasons for its inclusion in SOFA score.

The SOFA Score:

The SOFA score was first mooted almost three decades back, with the expanded form initially being Sepsis-related Organ Failure Assessment and

later changed to the present avatar of Sequential Organ Failure Assessment score. It assesses six organ systems through one representative parameter each (clinical or laboratory), viz, respiratory (ratio of partial pressure of arterial oxygen to fraction of inspired oxygen), hepatic (serum bilirubin level), coagulation (international normalized ratio), neurological (Glasgow coma scale), renal (serum creatinine and urine output) and cardiovascular (mean arterial pressure) systems. Each of the values of the respective systems is given a score from 0-4, depending on the severity of dysfunction. The score was primarily used to predict the risk of mortality in patients admitted to ICU but also a marker for organ dysfunction. The SOFA score's forte lies in amalgamating the grade of dysfunction of different organ systems.[1]

Over the years, the SOFA score came to be used more widely. A change in SOFA score of ≥ 2 points, as a result of infection, defines the minimum degree of organ dysfunction to label the diagnosis of sepsis in a patient. It is a vital tool to quantify the clinical condition of the patient, response to the intervention and prognostication. The maximum SOFA score recorded for a patient during the ICU admission correlated well with mortality.[2]

Acute gastrointestinal injury:

Acute gastrointestinal injury (AGI) was defined as gastrointestinal dysfunction or failure caused by an acute illness. Intestinal function is vital in determining the outcome of critically ill patients. Feeding intolerance due to delayed gastric emptying is encountered in about 50% of patients receiving mechanical ventilation, adversely affecting ICU mortality and prolonging the length of stay.[3] Another study reported that gastrointestinal (GI) symptoms are present in as many as 62% of patients, and the presence of GI symptoms was related to poor prognosis in critically ill patients.[4] The incidence of acute GI injury among critically ill with novel coronavirus disease (COVID-19) was found to be 86.7%, and the 28-day hospital mortality was 48.2%.[5]

Unlike the six other organ dysfunctions, the AGI score has not been included in the SOFA score. However, it has been appreciated for more than two decades that the gastrointestinal system plays a vital role in the initiation and evolution of critical illness and the mortality associated with sepsis.[6]

The possible reasons quoted for not integrating GI injury score in SOFA are as follows:

1. There must be a unanimously accepted definition, classification and sub-scoring system of GI injury.[7,8]
2. There is a wide diversity of clinical manifestations of GI injury.[9]
3. There is a dearth of well-validated laboratory markers of GI injury, e.g. citrulline.[10]
4. Till 2012, no scoring system was available for assessing the GI system, diagnostic reliability and accurate assessment of the incidence of gastrointestinal failure (GIF).[3]

Predictability of SOFA score with and without gastrointestinal dysfunction score:

Jones AE et al. (2009) reported that the area under the receiver operating characteristics curve (AUROC) of SOFA score of patients at their admission to the emergency department and the one at 72 hours after admission for mortality prediction was reported to be 0.75 (95% CI 0.68-0.83), and 0.84 (95% CI 0.77-0.9), respectively. The study also demonstrated a statistically significant relationship between delta SOFA over 72 hours and in-hospital mortality.[11]

A logistic regression (LR) model for the correlation of SOFA score and mortality demonstrated that with the maximum SOFA score during the ICU stay, the AUROC was 0.847. With the SOFA score on the day of admission and the delta SOFA score, the AUC was more modest at 0.772 and 0.742, respectively.[12] When the gastrointestinal failure (GIF) score was combined with the SOFA score, the AUROC was 0.895, which was higher than the mean SOFA scores alone (0.84) or the mean GIF score (0.753). Thus, the mean GIF score of the first three days proved to be an independent risk factor for ICU mortality and, when added to the SOFA score, improved the predictivity of the latter.[3] In another study from Egyptian ICUs, the authors showed that when the GI dysfunction score was integrated into the SOFA score, it had a better predictability of ICU mortality (AUROC of 0.92) than the SOFA score alone (AUROC 0.89).[13]

Aperstein Y et al. (2019) utilized machine learning prediction models to examine the likely improvement in the predictive power of SOFA score by adding the severity of GI dysfunction. They found that when the GI failure tool and penalty function were added to the latest SOFA score, AUROC improved to 0.9146 from 0.906 when only the SOFA score was considered.[6]

When the SOFA sub-scores (e.g. hepatic, renal, cardiovascular, neurological, hematological or respiratory SOFA) and GIF score were compared by regression analysis for their ability to predict ICU mortality, it was found that the GIF score had the highest odds ratio of 2.2 for predicting ICU mortality, compared to all six sub-scores of SOFA.[3]

Hai PD et al (2024) studied the prognostic value of acute GI injury alone or combined with disease severity scores like SOFA, (acute physiology and chronic health evaluation) APACHE II score in predicting mortality of patients in the ICU. They reported that the AUROC of AGI was 0.67 (95% CI, 0.56-0.79; p=0.008), but it rose to 0.71(95% CI, 0.6-0.82; p=0.001) and 0.73 (95% CI, 0.62-0.84; p<0.001) when it was combined with SOFA and APACHE II respectively. Multivariate analysis for predictors of in-hospital mortality in critically ill patients showed that the hazard ratio of AGI was 3.93 (95% CI, 1.42-10.84; p=0.008) and only AGI score had the ability to independently predict mortality in the critically ill patients [14].

Thus, all studies are unanimous that the incorporation of GI injury/failure score with SOFA improves the mortality prediction of SOFA by varying degrees.

Absence of credible biomarkers:

Two biomarkers, viz, citrulline and intestinal fatty-acid binding protein (I-FABP), were touted in initial studies as possible biomarkers whose serum levels would reflect the severity of GI dysfunction. However, they failed to prove their worth in replacing the subjective assessment of GI symptoms.[15] It is worth mentioning that there are no reliable biomarkers for assessing neurological dysfunction, and the clinical assessment tool, the Glasgow Coma Scale, is used as a neurological sub-score in calculating the SOFA score.

Grading of GI Dysfunction:

There is no universally accepted tool to assess GI function. A score to grade GI dysfunction should be specific, sensitive, and objective, including continuous variables mirroring organ function.[8] Moreover, no single score is equipped to describe all GI functions like endocrine, immune and barrier functions, and absorptive and digestive functions.[8]

Reintam A et al. in 2008 graded GIF as 0 for normal GI function, grade I as enteral feeding, which was <50% of that calculated for the patient or no feeding three days after abdominal surgery; grade II was food intolerance; grade III was food intolerance along with intra-abdominal hypertension; and, grade IV was if abdominal compartment syndrome was present.[3] The preceding grading system classifies 'Gastrointestinal failure'; thus, the event is considered as a binary, i.e., either present or absent. A better approach would have been to grade GI dysfunction, including a continuum of physiologic disorders, from minimal disorder to dysfunction to failure.

The Working Group on Abdominal Problems of the European Society of Intensive Care Medicine (ESICM) graded AGI based on gastrointestinal and intra-abdominal symptoms, with or without feeding intolerance. According to them, Grade I was an increased risk of GI dysfunction or failure (a self-limiting function); Grade II, GI dysfunction requiring interventions; Grade III, GI failure where the function cannot be restored even with interventions; and Grade IV, a marked GI failure, a condition bad enough to pose an immediate threat to life.[4] AGI scores of 2012 had shortcomings, including a general subjective assessment of the patient's conditions and emphasis on feeding intolerance and its management. Feeding intolerance itself needs to be better defined, and it depends on local feeding practices. Thus, the AGI scores are subjective and prone to inaccurate scoring and poor clinical applicability.[8] Moreover, it is not based on numeric variables. The descriptions of the grades are complex; the same grade may have different clinical manifestations.[4]

Blaser AR et al. (2021) developed a new gastrointestinal dysfunction score (GIDS) for critically ill patients with five grades.[15] Intra-abdominal pressure (IAP) was included in GIDS scoring, which is not a direct measure of GI function. The five grades were Grade 0, no risk; Grade I increased risk; Grade II, GI dysfunction; Grade III, GI failure; and Grade IV, life-threatening.[15] GIDS was more objective and possessed maximum reproducibility.[8]

Rationale for inclusion of GI injury score in SOFA score:

As the SOFA score's predictability is modest, adding the GI dysfunction sub-score will not only improve its predictability but also will nudge the intensivists regarding the importance of assessing GI dysfunction in all critically ill patients.

GIT indeed has several functions besides the primary function of digestion and assimilation of nutrients like endocrine, immune and barrier functions.[4] There are no tests, clinical or otherwise, to assess the later functions. Kidneys have several secondary functions, like erythropoiesis, vitamin D synthesis, and blood pressure regulation, and the liver has excretory, synthetic, and glucose hemostasis. However, SOFA sub-scores for these organs only assess their primary function. So, the GIDS, with its somehow limited ability to assess the functions of GIT, should be acceptable as it objectively assesses the primary function of the gut.

It is also agreed that the inclusion of the GI dysfunction score in the SOFA will institute the basis for developing a bundle of prophylactic and therapeutic measures of GI dysfunction and spur the development of innovative treatment approaches.[4] Indeed, there are few studies that validated GIDS. However, this should not be any hurdle in including it in the SOFA score as several organ dysfunction scores, including SOFA, were developed first and validated later on.[4]

Conclusion:

It is high time that a scoring system which assesses the dysfunction of the GIT should be incorporated into the SOFA score to improve its ability to predict the mortality of critically ill patients, prompt the intensivists to look out for symptoms of GI dysfunction and drive the development of innovative treatment approaches.

Highlights:

1. The SOFA score is used to predict the risk of mortality in patients admitted to the ICU.
2. Gastrointestinal (GI) symptoms are present in more than half of the critically ill patients and dictate poor outcomes.
3. Mortality prediction of SOFA score improves when GI injury score is integrated into it.

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