Shock Index in COVID Era

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Introduction

Shock, a clinical state of impaired oxygen delivery or utilization, is a major cause of mortality, morbidity, and increased resource utilization in the critically ill patient cohort.1 Time-sensitive intervention and treatment as emphasized by the early researches mandate the need of an early identification strategy.2,3 In this context, an exhaustive list of clinical, hemodynamic, and laboratory parameters (►Table 1) have been evaluated in various surgical and nonsurgical patient populations. However, a mere correction of these parameters does not necessarily improve outcome in shock patients.4 Moreover, lack of specificity, invasive nature of the laboratory parameters, and need of additional monitoring equipments and expertise (such as ScvO₂ [central venous oxygen saturation], cardiac output, echocardiography, etc.) construct the ground to formulate other novel risk stratification parameters.

Types of SI

Originally SI was formulated to include both vascular and myocardial component (as reflected by SBP and HR, respectively) and a value more than the normal range (0.5–0.9) predicted poor tissue perfusion as evidenced by a positive correlation with serum lactate and mixed venous oxygen saturation.5 Subsequently, several modifications have been made to address the aforementioned issue as enlisted in ►Table 2. Additionally, respiratory rate and SpO₂...
septic/distributive shock; a direct injury to the myocardium.

Circulating cytokine storm giving the etiology of shock.

Obstructive shock; and, finally, sudden pulmonary thromboembolism (owing to the inherent hypercoagulable disease pathology) and tension pneumothorax form the etiology of obstructive shock. Therefore, a close monitoring and early detection of the shock pathology are the cornerstone for a better outcome.

Where Can it Help (in COVID-19)?

Despite the continuous endeavor and ongoing researches, little is known about the novel coronavirus disease 2019 (COVID-19) and subsequent management of the patients requiring intensive care unit (ICU) admission. According to few studies, about 5 to 10% of the patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) require ICU admission. Shock (up to 67% of patients admitted in the ICU) has been implicated as the primary cause of death in 7% of COVID-19 cases and as a contributing factor in an additional 33%. All the four types of shock (hypovolemic, cardiogenic, hemorrhagic, and obstructive) have been observed in COVID-19 patients owing to the peculiar pathophysiology of the disease—hypovolemia occurring due to the associated fever, diarrhea, and fluid restrictive treatment protocol; systemic inflammation with circulating cytokine storm giving the etiology of septic/distributive shock; a direct injury to the myocardium due to myocarditis and pulmonary hypertension (caused by positive pressure ventilation, chronic hypoxia, pulmonary fibrosis) leading to right ventricular dilatation, all can attribute to the myocardial dysfunction leading to cardiogenic shock; and, finally, sudden pulmonary thromboembolism (owing to the inherent hypercoagulable disease pathology) and tension pneumothorax form the etiology of obstructive shock. Therefore, a close monitoring and early detection of the shock pathology are the cornerstone for a better outcome.

The available literature demonstrated the equivalent efficacy of SI with qSOFA in trauma triage scenario. Another study depicted the positive correlation between serum lactate and diastolic SI and qSOFA in trauma patients.

Encouraging Literatures

Diverse Patient Populations

Till date, various scoring system and indices have been evaluated in COVID-19 patients for prognostication and risk stratification, with variable success. In this context, quick sequential organ failure assessment score (qSOFA), combining respiratory rate, neurological status, and hemodynamics; CURB 65; NEWS (National Early Warning Score); and 4C mortality scores have been validated with improved predictive efficacy. The available literature demonstrated the equivalent efficacy of SI with qSOFA in trauma triage scenario.
better prognostic efficacy in septic shock patient cohort recruited from ANDROMEDA-SHOCK trial. Similarly, respiratory adjusted shock index (RASI) and shock index to SpO2 ratio (SI) have been validated in acute respiratory distress syndrome (ARDS) and community-acquired pneumonia patients to predict the need for mechanical ventilation and hospitalization. Jiang and colleagues have successfully applied RASI in sepsis for identifying occult shock and subsequent triage of the patients for the level of care required. Adjusting the cutoff appropriate for age, Ray and colleagues highlighted a better predictive efficacy of on admission SI pediatric age-adjusted (SIPA) over the conventional hemodynamic parameters (SBP, HR) and positive correlation with arterial lactate level. Utility of SI in different patient subgroups is enlisted in Table 3.

### Ambiguity in Cutoff

An increased SI value universally indicates hypoperfusion. However, there is no universal consensus regarding the cutoff value for SI in adult patients. Previous researches demonstrated multiple cutoff values as documented in Table 4.

### Limitations of SI

First, SI value doesn’t change over a wide range of cardiovascular compensatory phase (increase in heart rate to compensate hypotension), particularly in the younger age group. Second, the mode of blood pressure recording (invasive vs. noninvasive) is not universal in the existing literature. Accordingly, the variations in systolic, diastolic, and mean blood pressure between noninvasive and invasive method would create ambiguity in calculating the SI value, specifically in the shock state.

### Conclusion

SI, a noninvasive, simple, dynamic, objective, and parsimonious index, can appropriately predict the outcome in COVID-19 patients and upgrade the patient care in a timely manner. As it is aptly said, to be forewarned is to be forearmed and half the victory.

### Conflict of Interest

None declared.

### References

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