Editorial

It has been shown in previous studies that isolated vital signs including heart rate (HR) and/or blood pressure (BP) are unreliable in the assessment of hypovolemic shock in these patients. On the contrary, SI (defined as the ratio of HR to systolic blood pressure) has been shown to be a pragmatic and useful tool for diagnosing hypovolemic shock even in the presence of a normal HR or BP. Also, SI is very simple to calculate in the chaotic pre-hospital and/or trauma bay setting making it a very practical and useful tool. Previous studies have already found that trauma patients with an SI > 0.9 have a greater mortality rate. SI has also been shown to assist in the identification of shock states in polytrauma patients.[1]

The American College of Surgeons has defined in its training program Advanced Trauma Life Support (ATLS) four classes of hypovolemic shock. This classification is based upon an estimated percentage of blood loss and corresponding vital signs, such as the heart rate, systolic blood pressure and the mental status to allocate each patient to their respective shock class. However, the clinical validity of the ATLS classification of hypovolemic shock has been recently questioned. As an alternative, a classification based on the physiological parameter SI has been proposed by Mutscler et al to differentiate the presence and extent of hypovolemic shock in trauma patients. The purpose of such a classification is to be able to discriminate the patient at risk for early blood transfusions and death more appropriately than the current ATLS classification.[2]

Despite the evidence that SI is a good pre-hospital tool to identify patients with shock, predicting the need for transfusion after injury remains a significant dilemma. The decision to initiate a massive transfusion protocol in the trauma patient is a risk *vs* benefit choice often made under duress. There is little evidence to identify which trauma patients will ultimately require activation of a massive transfusion protocol from those who will not. The ability to quickly and accurately identify patients who will benefit and exclude patients at risk of harm is critical. Mutscler and colleagues have also proposed the utility of SI as a potentially helpful decision aid.[2]

Rady et al also demonstrated that SI correlates with other indices of end organ perfusion, such as central venous oxygen saturation and arterial lactate concentration. These same authors found that in a cohort of 275 adult trauma patients with an SI > 0.9 there was an associated worse outcome. Montoya et al[5] independently discovered that in their cohort of 666 patients, those with an ISS > 16 and an arterial lactate > 3, 49 correlated with an SI >0.9. This goes along with the notion that the more severely injured a patient is the greater the possibility of that patient presenting to the trauma bay in hypovolemic shock.[3]

Sloan et al showed that trauma patients with an SI > 1.0 were 2.3 to 3.1 times more likely to die by 28 days than were patients with SI values below this cutoff ($p < 0.001$). Zarzaur and colleagues demonstrated that the SI was also a significantly better predictor for 48 hour mortality compared to systolic blood pressure and heart rate.[4] Montoya et al were able to further expand on these findings and determined that an SI > 0.9 correlated with an early (<24 hours) mortality of 59.5% ($p = 0.027$), findings which have never been published before.[5]

The cardiovascular response in patients with blunt trauma has been speculated to perhaps differ from those with penetrating injuries. As the percentage of penetrating trauma patients was of 53.2% in Group B in Montoya's et al[5] study, the utility of the application of the SI was not independently verified in this subgroup. Further validation specifically in penetrating injuries is required to assess the accuracy of the application of the SI in these patients.

Shock index may be used to assess the presence of hypovolemic shock, especially if point-of-care testing technology is not available, as is the case in many Latin-American countries. The practicality of using laboratory values is limited by the time required to obtain these results and the expense of having this point-of-care testing technology available 24/7 at the institution. I propose that a future possible area of study for Montoya et al[5] could be a prospective clinical and cost-effectiveness evaluation between thromboelastography (TEG)/arterial lactate concentration and/or Arterial Base Deficit *vs* SI to determine each ones innate ability to predict the need for massive transfusion in trauma patients.

Another short coming of the study was the non-inclusion of the modified shock index (MSI) which is defined as the ratio of HR to mean arterial blood pressure (MAP). Modified shock index is essential because MAP best represents tissue perfusion status. Modified shock index takes into account valuable information related to cardiovascular and hemodynamic stability by incorporating heart rate, systolic and diastolic blood pressure, thus, making it a comprehensive tool for assessing stroke volume and systemic vascular resistance in trauma patients. A high MSI (>1.3) indicates a hypodynamic circulatory state and a low MSI (<0.7) indicates a hyperdynamic state, both of which have been demonstrated to be predictors of mortality.[6]

Further prospective study to validate the applicability of the SI and MSI is warranted.

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