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Shock Index

The shock index may be a more sensitive indicator of occult shock than heart rate or blood pressure alone, especially in patients with trauma or acute hemorrhage.

Points & Pearls

- The shock index is calculated as heart rate divided by systolic blood pressure.
- There are currently no large-scale prospective studies validating the use of the shock index to guide resuscitative intervention.
- A shock index value > 1.3 has been shown to correlate with an increased risk of mortality (likelihood ratio of 5.67) and hospitalization (likelihood ratio of 6.64) (Al Jalbout 2019).
- A pediatric age-adjusted shock index is more accurate than the shock index for identifying the most severely injured patients aged ≤ 16 years (Acker 2015).

Evidence Appraisal

The shock index was first proposed in the literature in 1967 by Allgöwer and Burri as a measure of shock severity. More recently, the shock index has been studied further with modern protocols.

In a retrospective study by Mutschler et al (2013), 21,853 patients were identified in a trauma registry. Each patient's shock index value was calculated based on vital signs taken on arrival at the emergency department. The degree of shock was found to correlate with increasing shock index values. The need for blood products, fluids, and vasopressors was also found to increase with higher shock index values.

A retrospective study by Cannon et al (2009), performed at a single Level I trauma center,

identified 2445 patients admitted over a 5-year period. Patients with a shock index value > 0.9 were found to have a significantly higher mortality rate (15.9%) when compared with patients with a normal shock index (6.3%)

In a retrospective registry study by Vandromme et al (2011), the authors identified 8111 patients with blunt trauma who were admitted at a single Level I trauma center over an 8-year period. The shock index value for each patient was calculated from recorded prehospital vital signs, and patients with a shock index value > 0.9 were found to have a 1.6-fold higher risk for massive transfusion.

In a retrospective study of 542 patients who underwent emergency intubation, Heffner et al (2013) identified a pre-intubation shock index value ≥ 0.9 to be independently associated with peri-intubation cardiac arrest.

A retrospective study of 2524 patients at a single center who were screened for severe sepsis found that a shock index value ≥ 0.7 performed as well as the SIRS (systemic inflammatory response syndrome) criteria in negative predictive value and was the most sensitive screening tool for hyperlactatemia and 28-day mortality (Berger 2013).

The Protocolized Care for Early Septic Shock (ProCESS) trial (a large, multicenter prospective randomized controlled trial that enrolled 1341 patients) compared 3 different protocols for resuscitation of septic patients, including a protocol that used a shock index value ≥ 0.8 as a fluid resuscitation goal. The study found no significant difference in mortality between the 3 intervention groups (Yearly 2014).

CALCULATOR REVIEW AUTHOR

Kamal Medlej, MD

Department of Emergency Medicine, Massachusetts General Hospital, Boston, MA

Why to Use

When used individually, blood pressure and heart rate may fail to predict accurately the severity of hypovolemia and shock in major trauma. When initiated inappropriately, massive transfusion of blood products can be associated with significant risk. Identifying patients who are likely to require massive transfusion can be difficult, and objective measures such as the shock index can help. The shock index has also been shown to be more sensitive than the ABC score for massive transfusion (Schroll 2018).

When to Use

Clinicians should consider using the shock index in the following scenarios:

- For patients presenting with hemorrhage and trauma, to identify patients who are at increased risk for needing massive transfusion.
- For patients requiring endotracheal intubation, to help identify patients at risk for postintubation hypotension.
- For patients with suspected sepsis.

The shock index has been found to be as sensitive as the SIRS criteria to identify patients at risk for sepsis (Berger 2013). However, a large randomized controlled trial showed that use of the shock index to guide fluid resuscitation in sepsis did not demonstrate an improvement in mortality (Yearly 2014).

Next Steps

The accuracy of the shock index for identifying trauma patients in need of massive blood transfusion has not yet been prospectively investigated.

Abbreviations: ABC, assessment of blood consumption; SIRS, systemic inflammatory response syndrome.

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Calculator Creator

Manuel Mutschler, MD

[Click here to read more about Dr. Mutschler.](#)

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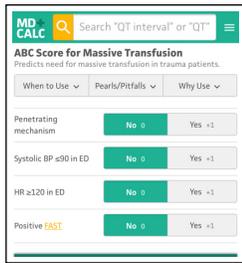
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ABC Score for Massive Transfusion

The ABC score for massive transfusion predicts the need for massive transfusion in trauma patients.

Points & Pearls

- The assessment of blood consumption (ABC) score does not require laboratory results or complex calculations.
- The focused assessment with sonography in trauma (FAST) examination that is used to determine the score relies on the skill level of the clinician performing and interpreting the examination.
- The score tends to overtriage in favor of receiving massive transfusion, ensuring a low chance of withholding massive transfusion from a patient who needs it.
- While the score can help aid the decision to initiate massive transfusion, the lead clinician(s) managing the trauma should place the order, as a massive transfusion can quickly stretch the limits of the hospital blood supply.

Critical Actions

Activation of a massive transfusion protocol (MTP) triggers the release of packed red blood cells, platelets, and fresh frozen plasma at frequent intervals until the MTP is called off.

Evidence Appraisal

The original study (Nunez 2009) was a retrospective review performed at Vanderbilt University Medical Center using the institution's trauma registry. The study population was derived from all trauma patients admitted to the hospital over the course of a year ($n = 596$). Patients included were Level I trauma activations transported directly from the scene who received any blood transfusion while admitted. The ABC score was created by the trauma faculty based on clinical experience, and logistic regression modeling was used to determine the odds ratio of requiring MTP for each parameter of the score.

Of the total cohort, 76 patients (12%) required massive transfusion in the first 24 hours. Based

CALCULATOR REVIEW AUTHOR

Cullen Clark, MD

Emergency Medicine and Pediatrics Departments, Louisiana State University Health Sciences Center, New Orleans, LA

Why to Use

Early initiation of massive transfusion has been shown to improve survival in critical trauma patients. The ABC score reduces delay in determining need for massive transfusion in a trauma patient, while also providing consistency in appropriateness of transfusion by minimizing practice variations among clinicians.

When to Use

The ABC score should be used in trauma patients for whom massive transfusion is being considered.

Next Steps

- Massive transfusion protocols are institution-specific, but common ratios are 1:1:1 or 1:1:2 for fresh frozen plasma, platelets, and packed red blood cells (Holcomb 2015).
- The ABC score does not indicate if trauma patients should receive blood, only if they should receive blood through an MTP.
- The score should be repeated as the patient's clinical examination changes. Repeating vital signs and FAST examinations can change a patient's ABC score.
- Familiarity with an institution's MTP will reduce delays in activation and administration of blood products.
- The most widely accepted definition of massive transfusion is the administration of ≥ 10 units of packed red blood cells in the first 24 hours.
- Institutions may have different ratios of blood products as part of an MTP.
- Chances of survival increase with early initiation of massive transfusion in severely injured patients. Identification and activation should not be delayed in critical trauma patients.

Abbreviations: ABC, assessment of blood products; FAST, focused assessment with sonography in trauma; MTP, massive transfusion protocol.

on the number of patients who received massive transfusion and were identified using the ABC score, researchers found the best cutoff to be a score ≥ 2 , giving a sensitivity of 75% and specificity of 86%. Compared with the Trauma Associated Severe Hemorrhage scoring system and the McLaughlin score using the same dataset, the ABC score was shown to be the most accurate in predicting need for MTP.

The validation study (Cotton 2010) was a retrospective review using trauma databases from 3 institutions: Vanderbilt University Medical Center, Johns Hopkins Hospital, and Parkland Memorial Hospital. The inclusion and exclusion criteria were the same as the original study. The study population was again derived from trauma patients admitted to 1 of the 3 hospitals over the course of a year. The sample size of the study was 1604, including 586 patients from the original study. There was significant variation in demographics between the centers involved, but the massive transfusion rate in the first 24 hours of admission was similar for each hospital (approximately 15%). There was little variability between each institution's cohort in the percentage of patients correctly classified as meeting the ABC score cutoff for MTP, among those who received massive transfusions. For each institution, sensitivity ranged from 76% to 90% and specificity ranged from 67% to 87%. Negative predictive value was 97% and positive predictive value was 55%.

The validation study also measured the accuracy of the ABC score at predicting need for massive transfusion in the first 6 hours of admission. Sensitivity was 87% and specificity was 82%, with slightly higher negative predictive value (98%) and lower positive predictive value (55%) compared to prediction of massive transfusion need in the first 24 hours.

The major limitation to both studies was their retrospective nature. A prospective trial is ongoing. The study shows a novel means of quickly predicting the need for massive transfusion based on objective measures. While there are good data showing that early activation of MTP improves survival rates in severely injured trauma patients, a prospective study will be necessary to determine whether utilization of the ABC score improves patient outcomes.

Use the Calculator Now

[Access the ABC Score for Massive Transfusion on MDCalc.](#)

Calculator Creator

Bryan Cotton, MD

[Read more about Dr. Cotton.](#)

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Contact EB Medicine:
Phone: 678-366-7933
3475 Holcomb Bridge Rd
Suite 100
Peachtree Corners, GA 30092



Contact MD Aware:
MDCalc
Phone: 646-543-8380
12 East 20th Street
5th Floor
New York, NY 10003

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