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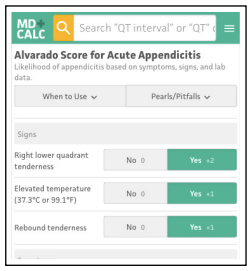

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Alvarado Score for Acute Appendicitis

The Alvarado score for acute appendicitis predicts the likelihood of a diagnosis of appendicitis.

Points & Pearls

- The Alvarado score is more accurate at the extremes than for equivocal scores, so it is unclear whether the score is better than clinical gestalt.
- Symptoms may overlap with other diseases; ie, higher scores are found in patients with nonappendiceal inflammatory conditions, such as diverticulitis or acute pelvic inflammatory disease. It is important to consider the whole clinical picture in making the diagnosis of appendicitis.
- There are several modifications of the Alvarado score in use; these modifications may be appropriate in specific settings, such as for pregnant patients, children, or in low-resource facilities with limited or no laboratory testing capability, but the original score remains the best studied and validated in a general population.

Critical Actions

Clinicians should use clinical judgment in nonclassic presentations of appendicitis.

Evidence Appraisal

The Alvarado score was initially described in 1986 by Dr. Alfredo Alvarado in a retrospective study at a single center in Philadelphia. In 305 patients aged

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Why to Use

Acute appendicitis is a common surgical emergency in the United States. Diagnostic accuracy for appendicitis is increased with the use of CT scanning; however, there are risks and disadvantages associated with CT scans, including radiation exposure, contrast-related complications, and cost. The Alvarado score is a well-established and widely used clinical decision tool that may help reduce the need for CT scans in diagnosing appendicitis.

When to Use

The Alvarado score can be used for patients with suspected acute appendicitis (typically, patients presenting with right lower quadrant pain).

Next Steps

- Cutoffs differ by study, but one validated stratification assigns the highest risk to Alvarado scores ≥ 9 in men and a score of 10 in women; the lowest-risk scores were ≤ 1 in men and ≤ 2 in women (Coleman 2018).
- In patients whose score indicates high risk, treatment without obtaining CT imaging should be considered. Alternative diagnoses should be considered in patients whose score indicates low risk. In patients with equivocal scores, CT scanning should be considered to help clarify the diagnosis.

Abbreviation: CT, computed tomography.

4 to 80 years, 8 predictive factors were identified to stratify the risk of acute appendicitis. Increasing scores were found to correlate with increasing risk for appendicitis, as determined by final surgical pathology.

In 2007, McKay et al studied a retrospective cohort of 150 patients (aged ≥ 7 years) presenting with abdominal pain, with the aim of stratifying risk specifically for the use of computed tomography (CT) scanning for diagnosis. They found 35.6% sensitivity for appendicitis based on equivocal Alvarado scores (defined as scores of 4-6) compared with 90.4% sensitivity based on CT scan in this group. They concluded that patients with equivocal scores would benefit from CT scanning.

Similarly, Coleman et al (2018) conducted a retrospective review in which the Alvarado score was applied to a cohort of 492 patients (median age = 33 years), and found that 20% of the patients were in either the high-risk group (defined as scores ≥ 9 in men or a score of 10 in women) or the low-risk group (scores ≤ 1 in men and ≤ 2 in women). These patients spent a cumulative total of > 170 hours awaiting CT scanning that was ultimately unnecessary. The authors found that scores of 0 or 1 had 0% incidence of acute appendicitis and that 100% of men with a score ≥ 9 and 100% of women with a score of 10 had acute appendicitis confirmed on surgical pathology.

Pogorelić et al (2015) prospectively studied 311 pediatric patients and applied both the Alvarado score and the pediatric appendicitis score (Samuel 2002). Receiver operating characteristic analysis showed similar accuracy between the scores, with area under the receiver operating characteristics of 0.74 (95% confidence interval, 0.66-0.82) for the Alvarado score and 0.73 (95% confidence interval, 0.65-0.81) for the pediatric appendicitis score. The authors concluded that the scores may be useful in emergency settings, but neither score is superior to the clinical gestalt of a pediatric surgeon.

Use the Calculator Now

Click here to access the Alvarado score on MDCalc.

Calculator Creator

Alfredo Alvarado, MD
Click here to read more about Dr. Alvarado.

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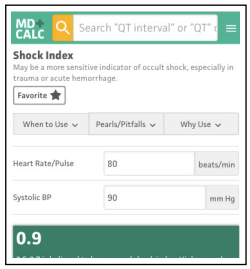

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Shock Index

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 futher with modern protocols.

In a large 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

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Why to Use

Blood pressure and heart rate, when used individually, fail to predict accurately the severity of hypovolemia and shock in major trauma. Massive transfusion of blood products can be associated with significant risk when initiated on the wrong patient. 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 (assessment of blood consumption) 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 of 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.

Abbreviation: SIRS, systemic inflammatory response syndrome.

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).

Of note, in the ProCESS (Protocolized Care for Early Septic Shock) trial (a large, multicenter prospective randomized controlled trial that enrolled 1341 patients), the investigators 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).

Use the Calculator Now

Click here to access the shock index on MDCalc.

Calculator Creator

Manuel Mutschler, MD
Click here to read more about Dr. Mutschler.

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This edition of *Calculated Decisions*, powered by MDCalc, is published as a supplement to *Emergency Medicine Practice* as an exclusive benefit to subscribers. *Calculated Decisions* is the result of a collaboration between EB Medicine, publisher of *Emergency Medicine Practice*, and MD Aware, developer of MDCalc. Both companies are dedicated to providing evidence-based clinical decision-making support for emergency medicine clinicians.

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