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THE BRASS TACKS: CONCISE REVIEWS OF PUBLISHED EVIDENCE

Ankle–brachial index for diagnosis of arterial injury in penetrating extremity trauma

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Summary heading	A normal ankle–brachial index in a patient without any hard or soft signs on physical examination significantly reduces the probability of arterial injury
Positive findings	*Ankle–brachial index*: Sensitivity = 49% (95% CI = 39% to 60%) +LR: Not reported
Negative findings	*Ankle–brachial index*: Specificity = not reported (data not pooled due to significant heterogeneity) LR– = 0.59 (95% CI = 0.49 to 0.72) Ankle–brachial index without any hard or soft signs (proximity to major artery was not studied) LR– = 0.01 (95% CI = 0.0 to 0.1)
Who was in the studies	1,040 adult patients with penetrating extremity trauma who underwent ankle–brachial index measurement.

NARRATIVE

Penetrating extremity trauma (PET) is a common cause of arterial injury in the United States.[1] PET can result in amputation, wound infection, venous thromboembolism, need for surgical interventions such as fasciotomy, and death.[2] The diagnosis of arterial injury in patients with PET has been the subject of debate with differing recommendations by professional society and major trauma guidelines (Table 1).[3,4]

The systematic review discussed here assesses the accuracy of the ankle–brachial index (ABI) in the diagnosis of arterial injury in patients with PET.[5] The systematic review identified five prospective studies of 1,040 adult patients with upper or lower PET who underwent ABI. The prevalence of arterial injury was 14.3%. Due to considerable heterogeneity (I^2 > 75%), the authors chose not to calculate a pooled positive likelihood ratio (LR+) for ABI.[6] The pooled negative likelihood ratio (LR–) for ABI was 0.59. Although this review concluded that ABI cannot independently exclude arterial injury, the systematic review suggested that such injuries can be excluded in patients with no hard or soft signs and a normal ABI (≥0.9).

CAVEATS

There are some limitations of the systematic review and meta-analysis. While all studies were prospective and the majority at low risk of bias, a considerable degree of heterogeneity existed among studies with regard to physical examination findings for arterial injury. The authors attributed this heterogeneity to the varying definition of hard and soft signs of arterial injury used across the included trials that originated from discrepancies in major trauma guidelines (Table 1).

Editor's Note: Brass Tacks are concise reviews of published evidence. This series is a result of collaboration between *Academic Emergency Medicine* and the evidence-based medicine website, www.TheNNT.com. For inquiries please contact the section editor, Shahriar Zehtabchi, MD (e-mail: Shahriar.Zehtabchi@downstate.edu).

TABLE 1 Definition of hard and soft signs in trauma guidelines

Guideline	Hard signs	Soft signs
Eastern Association for the Surgery of Trauma	Expanding hematoma Bruit Thrill Pulse deficit Pulsatile bleeding	History of arterial bleeding Proximity of wound to artery Neurologic deficit Nonexpanding hematoma
Western Trauma Association	Expanding hematoma Bruit Thrill Pulselessness Pallor Paresthesia Pain Paralysis External bleeding	History of arterial bleeding Proximity of wound to artery Neurologic deficit Small, nonpulsatile hematoma

Another limitation of the analysis is that not all patients received the reference standard diagnostic study. In almost all of the included trials, low-risk patients were observed for 24 h and did not undergo any of the predetermined reference tests: CT angiography, catheter angiography, or surgical exploration. The probability of clinically significant arterial injury (requiring intervention) in this population is likely to be low but cannot be accurately reported. A significant portion of these "low-risk" patients were then discharged and were lost to follow-up. This, therefore, creates risk of partial and differential verification bias.

Due to considerable heterogeneity, the systematic review did not report the posttest probability of arterial injury in patients with no hard signs of vascular injury. However, in patients with no hard or soft signs of vascular injury, a systematic review concluded that arterial injury can be ruled out if ABI is normal (≥0.9). This conclusion was drawn from two trials that included a group of PET patients without any hard or soft signs of arterial injury that underwent ABI testing. The review reports a pooled LR− of 0.01 for negative ABI in absence of soft or hard signs of vascular injury. The authors used the weighted prevalence of arterial injury in this subgroup of patients (16.3%) as an estimate of the pre-test probability and applied LR− of 0.01, arriving at a posttest arterial injury probability of 0% (95% CI = 0% to 1%). Based on this calculation, they suggested that this subset of patients may not need further testing. One limitation of this recommendation is its applicability in patients with PETs when the trajectory of injury is in proximity to a major artery. In contrast to the guidelines,[3,4] these two studies did not classify trajectory of injury in proximity to a major artery as a soft sign. In patients with such injuries, therefore, the review recommends that clinicians use their clinical judgment to decide whether to discharge, observe, or obtain further testing.

In summary, the existing evidence suggests that a normal ABI in the absence of soft or hard signs may rule out the presence of arterial injury in patients suffering from penetrating extremity injury. The data are insufficient to draw any conclusions about the use of ABI in any other penetrating extremity injury scenario.

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