

# Diagnostic Value of Ankle Brachial Index (ABI) in Lower Extremity Traumatic Injuries

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## INTRODUCTION:

Use of computed tomography angiography (CTA) for diagnosing traumatic arterial injuries has significantly increased over the past decade due to its rapid and accurate diagnostic capabilities. However, this increased utilization has led to potential adverse effects and resource overuse in trauma hospital settings. Furthermore, increasing demand for CTA, particularly from patients who may not require it, can result in prolonged wait times for those who need the test more urgently. Ankle-Brachial Index (ABI) provides a fast, accurate and easy way to identify the presence of arterial injury. Additionally, its utilization with minimal equipment makes it valuable in low resource settings. This study aims to compare the overall effectiveness of ABI measurements with CTA in diagnosing traumatic lower extremity arterial injuries.

## METHODS:

A retrospective review was conducted on 2,028 patients over a 5-year period (2019–2023) at a Level I trauma center. The study included patients above the age of 18 who sustained a lower extremity traumatic injury and underwent a CTA of the lower extremity, while excluding those with pre-existing peripheral vascular disease or incomplete medical records. Of the patients who underwent a CTA, we only included patients who also had an ABI measurement at the time of their injury. The study assessed the ability of ABI and CTA to diagnose an arterial injury in patients with lower extremity injuries. CTA findings, including any arterial damage, were compared with ABI results. The need for vascular intervention was also recorded. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for both diagnostic methods.

## RESULTS:

A total of 2,028 patients were reviewed with 322 patients meeting the study criteria. The patient cohort was split between patients with blunt trauma (151 patients, 46.9%) and penetrating trauma (171 patients, 53.1%). Among the 171 patients presenting with penetrating trauma, the majority (87.7%) experienced a gunshot wound (GSW). Meanwhile, among the 151 patients presenting with blunt trauma, the leading cause was a motor vehicle collision (MVC), accounting for 36.4% of cases.

Of the 322 patients, 142 (44.1%) had an abnormal ABI ( $<0.9$ ) and 180 (55.9%) had a normal ABI ( $\geq 0.9$ ). Negative CTA findings were found in 216 (67.1%) patients, minor CTA findings were found in 43 (13.4%) patients, and major CTA findings were found in 63 (19.6%) patients. Vascular intervention was performed in 43 (13.4%) patients.

Of the 142 patients with abnormal ABI measurements, blunt and penetrating trauma accounted for 74 (52.1%) and 68 (47.9%) patients, respectively. Within this cohort of patients, 98 (69.0%) patients had a positive CTA finding suggestive of arterial injury. Of this, 62 (43.7%) had major arterial injury and 36 (25.3%) had minor arterial injury. Meanwhile, 44 (32.0%) of patients with an abnormal ABI had no arterial injury on CTA. 100 (70.4%) patients with an abnormal ABI did not require a vascular intervention to be performed, while 42 (29.6%) did.

In the 180 patients with normal ABI measurements, blunt and penetrating trauma accounted for 77 (43%) and 103 (57%) patients, respectively. Within this subset of patients, 172 (95.6%) had negative CTA results, 7 (3.9%) had minor findings, and 1 (0.5%) had major arterial injury. 179 (99.4%) patients with a normal ABI did not have vascular intervention performed. This data is summarized in Table 1 below.

ABI demonstrated a specificity of 79.6% and a positive predictive value (PPV) of 69.0% ( $P < .0001$ ) relative to CTA findings. The area under the ROC curve for ABI was 0.86, indicating good discriminatory power. Subgroup analysis revealed similar predictive power for both blunt (ROC area 0.85) and penetrating trauma (ROC area 0.86). ABI likewise also demonstrated high sensitivity (92.5%) and negative predictive value (95.6%).

## DISCUSSION AND CONCLUSION:

This study assesses the diagnostic utility of the Ankle-Brachial Index (ABI) compared to computed tomography angiography (CTA) in detecting arterial injuries following lower extremity trauma. ABI, a simple and accessible bedside tool, demonstrated a high sensitivity of 92.5% and negative predictive value of 95.6%, supporting its role as an effective initial screening method. Among patients with normal ABI values ( $\geq 0.9$ ), only 0.5% (1 patient) had major arterial findings on CTA, and required vascular intervention. These findings suggest that ABI can help reduce unnecessary CTA use in trauma settings, especially when clinical signs are unremarkable.

However, 32% of patients with abnormal ABI results had no CTA-confirmed injury, indicating potential overuse of imaging based solely on ABI. ABI's specificity was 79.6%, and the area under the ROC curve (AUC) was 0.86, highlighting its strong diagnostic performance. In comparison to previous studies, such as those by Desouza et al. and Alagha et al., our findings reinforce ABI's utility in triage, while acknowledging limitations in its predictive precision.

Subgroup analysis revealed consistent ABI performance across both blunt and penetrating trauma, suggesting that mechanism of injury does not significantly alter its diagnostic value. When evaluating ABI and CTA for their ability to

predict the need for vascular intervention, both demonstrated similar specificity (~99.5%) and positive predictive value (97.7%). Their AUCs were also comparable (0.65 for ABI and 0.70 for CTA), indicating similar discriminatory power. In conclusion, ABI is a valuable, non-invasive tool that can aid in early decision-making for vascular imaging following lower extremity trauma. While not a replacement for CTA or clinical judgment, ABI can safely reduce unnecessary imaging when normal, helping clinicians prioritize care in time-sensitive trauma environments.

TABLE 1: RESULTS			
TOTAL PATIENTS (322)	ABI Abnormal (< 0.9)   n = 142	ABI Normal (≥ 0.9)   n = 180	p
<b>CTA</b>			< 0.001
Negative	44 (32%)	172 (95.6%)	
Minor	36 (25.3%)	7 (3.9%)	
Major	62 (43.7%)	1 (0.5%)	
<b>VASCULAR INTERVENTION</b>			< 0.001
NO	100 (70.4%)	179 (99.4%)	
YES	42 (29.6%)	1 (0.6)	
<b>BLUNT (N = 151)</b>	<b>ABI Abnormal (&lt; 0.9)   n = 74</b>	<b>ABI Normal (≥ 0.9)   n = 77</b>	
<b>CTA</b>			< 0.001
Negative	23 (31.1%)	74 (96.1%)	
Minor	22 (29.7%)	2 (2.6%)	
Major	29 (39.2%)	1 (1.3%)	
<b>VASCULAR INTERVENTION</b>			< 0.001
NO	54 (73%)	76 (98.7%)	
YES	20 (27%)	1 (1.3%)	
<b>PENETRATING (N = 171)</b>	<b>ABI Abnormal (&lt; 0.9)   n = 68</b>	<b>ABI Normal (≥ 0.9)   n = 103</b>	
<b>CTA</b>			< 0.001
Negative	21 (30.9%)	98 (95.2%)	
Minor	14 (20.6%)	5 (4.8%)	
Major	33 (48.5%)	0	
<b>VASCULAR INTERVENTION</b>			< 0.001
NO	46 (67.7%)	103 (100%)	
YES	22 (32.3%)	1 (0.6)	

Table 1: CTA Results and Vascular Intervention Stratified by ABI