

The utility of Ankle-Brachial Indices and Pulse Examinations: Are these still of value?

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INTRODUCTION:

Arterial injury following lower extremity trauma can lead to devastating limb loss if not promptly recognized and treated. Although CT angiography (CTA) is the gold standard for diagnosing vascular compromise, it may not always be immediately available in the acute trauma setting. Ankle-brachial index (ABI) and pulse examination are low-cost, readily accessible bedside tools used for initial triage, yet their diagnostic accuracy in the setting of fractures is variable. The purpose of this study was to evaluate the accuracy of ABI and pulse examinations in detecting vascular injury, using CTA as the reference standard. We also sought to categorize associated fracture patterns and mechanisms of injury in patients with documented arterial injury.

METHODS:

We performed a retrospective review of 123 patients with angiographically confirmed lower extremity vascular injuries secondary to traumatic fractures, treated at a single Level I trauma center between January 25, 2018, and November 8, 2023. Data extracted from the electronic medical record included demographics, injury mechanism, fracture location, vascular imaging, and physical exam findings.

All patients underwent at least one of the following assessments: ankle-brachial index (ABI), pulse examination, and/or computed tomographic angiography (CTA). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated using CTA as the reference standard. Two diagnostic subgroups were identified within a cohort of patients with confirmed vascular injury. The primary analysis included 88 patients who underwent both computed tomographic angiography (CTA) and pulse examination, allowing for assessment of pulse exam diagnostic accuracy. A focused subset of 24 patients received all three assessments—CTA, ankle-brachial index (ABI), and pulse exam—enabling a direct comparison of the diagnostic performance between ABI and physical examination. Fracture types and mechanisms of injury were categorized using standardized coding, and vascular injury patterns were confirmed through operative and radiologic documentation. Diagnostic concordance was assessed within each subgroup.

RESULTS:

Among the 88 patients who underwent both CTA and pulse examination, the pulse exam demonstrated a sensitivity of 80.9%, specificity of 37.5%, positive predictive value (PPV) of 90.2%, and negative predictive value (NPV) of 21.4% for detecting vascular injury. In the subgroup of 24 patients who underwent all three tests (CTA, ABI, and pulse exam), ABI demonstrated a sensitivity of 76.2% and PPV of 94.1%, while the pulse exam showed a sensitivity of 80.9% and PPV of 94.4%. Specificity and NPV were not calculated in this subset due to the absence of patients without vascular injury. A total of 198 fractures were recorded across the cohort. The most common fracture locations were the tibia (n = 66, 33.3%), femur (n = 50, 25.3%), and fibula (n = 54, 27.3%), with all other fracture types comprising 14.1% (pelvis n = 6, patella n = 6, distal tibia/ankle n = 11, foot n = 5). Mechanisms of injury included motor vehicle collisions (n = 40, 29.9%), blunt trauma (n = 29, 21.6%), and gunshot wounds (n = 26, 19.4%), with all other mechanisms (crush injuries, ground-level falls, falls from height, and electrocution) comprising 29.1%. The average Injury Severity Score (ISS) across the cohort was 17.7. The median time to vascular intervention was 3.4 hours. Among all the patients, compartment syndrome developed in 40.7%.

DISCUSSION AND CONCLUSION: Both ABI and pulse examination demonstrated high sensitivity and positive predictive value for detecting vascular injury in patients with lower extremity fractures. In the subgroup that underwent complete diagnostic evaluation, pulse exam showed slightly higher sensitivity than ABI. However, due to the inclusion of patients with confirmed vascular injuries in this cohort, specificity and NPV were not calculated. The high rate of tibial, femoral, and fibular fractures—particularly in the context of high-energy mechanisms such as motor vehicle collisions and gunshot wounds—highlights the need for rapid and reliable vascular assessment. These findings support the use of ABI and pulse exam as valuable frontline screening tools in trauma settings, particularly when CTA is not immediately available. Nevertheless, confirmatory vascular imaging remains essential for definitive diagnosis and surgical planning in patients with high-risk fracture patterns and clinical concern for arterial compromise.