

# ACS COT Residents Trauma Papers Competition Title Page

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# Open Vs. Endovascular Treatment of Traumatic Peripheral Arterial Injuries: A Propensity Matched Analysis

## Introduction:

Arterial injuries of the upper and lower extremities account for 3% of all civilian trauma and include both blunt and penetrating trauma. In civilian records, blunt injuries are usually caused by motor vehicle accidents while penetrating injuries are mainly related to criminal activity. Although most isolated injuries secondary to penetrating trauma are successfully treated, blunt trauma injuries have worse outcomes particularly in the setting of polytrauma.

The introduction of computed tomographic angiography (CTA) in the diagnostic process allowed for noninvasive and rapid detection of arterial injuries in the extremities. Historically, open repair has been the mainstay of surgical management for arterial vascular trauma. More recently, endovascular solutions are increasingly being utilized to treat these arterial injuries. While open surgical repair remains the gold standard for treating vascular trauma, the application of endovascular techniques is increasing. However, the definitive optimal treatment approach remains unclear and more data are needed to properly select the optimal management for patients with arterial trauma of the extremities.

The outcomes of patients with peripheral arterial trauma have improved over time, but there remain significant challenges with these injury patterns. This study aims to compare outcomes and readmission rates with open surgery to endovascular repair of traumatic arterial injuries. We hypothesize that the endovascular approach is associated with better outcomes compared to the open surgical approach.

## Methods:

We performed a 4-year (2011-2014) retrospective cohort analysis of the Nationwide Readmissions Database (NRD). We included all adult trauma patients (age  $\geq 18$  years) presenting with a primary diagnosis of peripheral arterial (axillary, brachial, femoral, and popliteal) injuries. We excluded patients with severe injuries in non-extremity body regions by eliminating patients with other body regions abbreviated injury severity (AIS) score  $> 2$ . We also excluded elective cases, transfer patients, patients declared dead on arrival, and patients with a known history of bleeding diathesis. Patients were stratified into two groups based on intervention: open surgical repair or endovascular repair. The primary outcome measures were in-hospital complications and hospital length of stay (LOS) on index hospitalization, 30-day readmissions, and 30-day mortality. The secondary outcome measure was the cost of index hospitalization and readmission. To ascertain the effect of surgical technique on patient outcomes while adjusting for measurable confounding factors (demographics, comorbidities,

injury parameters, and arterial vessel injured), we performed propensity score matching using a 1:2 matching ratio. A logistic regression model was used to generate a propensity score (ranging from 0 to 1) for each patient. A nearest-neighbor model match, using a caliper width of 0.1, was performed to identify patients that were subsequently included in the post-match analysis.

### **Results:**

A total of 8,024 adult trauma patients met the study's inclusion criteria: 5,350 underwent open surgical repair and 2,674 underwent endovascular surgical repair. Pre-match analysis of the baseline characteristics revealed significant differences between patients of the two groups in terms of the primary expected payer, median household income, comorbidities, and injury parameters.

A matched cohort of 786 patients was obtained: 524 underwent open surgical repair and 262 underwent endovascular surgical repair. Overall, the mean age was  $45 \pm 17$  years and 79% were male. Overall, 39% of patients had a median household income was between \$38,000 and \$47,999, and 38% of patients were covered by private insurance. Also, 49% of patients had comorbidities and 51% sustained blunt trauma. The overall ISS was 12 [8-18] and the highest AIS was in the extremity 3 [3-3]. No significant differences in any of the reported variables were noted following propensity score matching.

Patients in the open group had lower rates of developing seromas (2% vs 4%;  $p=0.04$ ), lower rates of arterial thrombosis (7% vs 13%;  $p<0.01$ ), and a shorter hospital LOS (3 [2-5] vs 4 [2-6];  $p<0.01$ ). There was no difference between the two groups in terms of rates of AKI ( $p=0.59$ ), DVT ( $p=0.45$ ), sepsis ( $p=0.21$ ), extremity amputations ( $p=0.66$ ), or in-hospital mortality ( $p=0.73$ ). Furthermore, patients in the open group had lower rates of 30-day readmission (7% vs 11%;  $p=0.03$ ) and 30-day open surgical reoperation (2% vs 6%;  $p<0.01$ ). Regarding hospital costs, patients in the open group had lower costs of both index hospitalization ( $p<0.01$ ) and readmission ( $p<0.01$ ).

### **Conclusion:**

On a national level, the use of open surgical repair for peripheral arterial injury is associated with improved outcomes and lower hospital costs. Given that endovascular repair is a less invasive procedure and is still evolving, its role in the management of peripheral arterial injury necessitates further considerations. Further clinical trials are needed to define the optimal patient who will benefit from endovascular repair.