

Clinical Science

# Perioperative outcomes of elective inflow revascularization for lower extremity claudication in the American College of Surgeons National Surgical Quality Improvement Program database



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## Abstract

**BACKGROUND:** We compared the early postoperative morbidity and mortality rates of contemporary aortofemoral bypass (AFB) and other inflow procedures for claudication.

**METHODS:** We identified 1974 claudicants who underwent elective AFB ( $n = 566$ ) or non-AFB (nonaortofemoral bypass [NAFB];  $n = 1408$ ) inflow reconstruction using the ACS-NSQIP database (2005 to 2012). Stent placement was not routinely captured. In propensity score–matched cohorts, we analyzed the association between type of inflow surgery and 30-day postoperative outcomes.

**RESULTS:** Among 824 propensity score–matched patients (AFB,  $n = 412$ ; NAFB,  $n = 412$ ), the 30-day mortality rate was 2.7% for AFB and .0% for NAFB ( $P = .0008$ ). NAFB conferred significantly lower rates of major cardiac (.2% vs 2.4%,  $P = .0063$ ), respiratory (.7% vs 10.9%,  $P < .0001$ ), renal (.2% vs 1.9%,  $P = .0380$ ), and septic (.5% vs 3.6%,  $P = .0014$ ) complications, and fewer returns to the operating room (4.6% vs 9.9%,  $P = .0032$ ), compared with AFB. Rates of major venous thrombosis, wound complications, peripheral nerve injury, and graft failure were similar between the groups.

**CONCLUSIONS:** This study reports a higher contemporary short-term complication rate with AFB compared to alternative inflow revascularization, against which future study of long-term durability may be weighed.

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Aortoiliac occlusive disease has been traditionally treated with aortofemoral bypass (AFB), an approach with varying degrees of morbidity and mortality dependent on many factors. Less invasive inflow procedures with variable durability have also been offered as 1st-line interventions, including femoral endarterectomy with inflow stenting, iliofemoral or femoral-femoral crossover, and axillofemoral bypass.<sup>1</sup> Deferring AFB may spare patients from a more complex initial operation and its concomitant greater risk of major complications including death. However, failure of a less invasive intervention and subsequent consideration of AFB may render the latter procedure increasingly complex. Although prior studies have documented differences in perioperative outcome between AFB and alternative inflow procedures, there has not been a contemporary, national, and multicentered analysis of the data. The purpose of this study was to identify differences in patient characteristics and perioperative outcomes of AFB and alternative inflow procedures for the treatment of claudication in a large national cohort of matched patients. We hypothesize that perioperative mortality and complications would be more frequent with AFB than alternative inflow procedures.

## Methods

### Study base

The study base was the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database (years 2005 to 2012). The 2012 installment includes multicenter data from 543,885 cases performed at 374 institutions.<sup>2</sup> Details on the accrual methods and validity of the ACS-NSQIP have been documented.<sup>2,3</sup>

### Inclusion and exclusion criteria

From the ACS-NSQIP reference population, we identified patients with the principal diagnosis of claudication who underwent either elective AFB (bilateral or unilateral) or elective non-AFB (NAFB) inflow procedures. Claudication was defined based on the International Classification of Diseases, Ninth Revision (ICD-9) code 440.21, "Atherosclerosis of native arteries of the extremities with intermittent claudication." Current Procedural Terminology (CPT) codes identified AFB and NAFB operations. The AFB cohort included patients undergoing bilateral (35646) or unilateral (35647) AFB, including transperitoneal and retroperitoneal approaches. The NAFB included patients undergoing one of the following procedures: common femoral artery (CFA) endarterectomy (35371), femoro-femoral bypass (35661), bilateral (35654) or unilateral (35621) axillofemoral bypass, or iliofemoral bypass (35665). Adjunctive femoral-popliteal bypass was identified using CPT codes 35,556 ("bypass graft, with vein;

femoral-popliteal"), 35583 ("in-situ vein bypass; femoral-popliteal"), and 35656 ("bypass graft, with other than vein; femoral-popliteal"). Adjunctive profunda endarterectomy was identified by CPT code 35372. Patients were excluded from the overall cohort with an affirmative response to the ACS-NSQIP variable indicating "history of revascularization or amputation for atherosclerotic peripheral vascular disease." Stent placement was not routinely captured over the 2005 to 2012 interval, which is a limitation of the ACS-NSQIP database. [Supplementary Table 2](#) displays the ICD-9 and CPT codes relevant to this analysis.

### Endpoints

The primary outcome was 30-day postoperative mortality. Secondary outcomes include major cardiac, respiratory, neurologic, renal, wound, infectious, venous thrombosis, and other complications within 30-postoperative days, as defined by the ACS-NSQIP variables.

### Statistical analysis

We tabulated demographic and clinical characteristics of patients who underwent AFB and NAFB. For the initial unadjusted analyses, categorical covariates were compared using the chi-square or the Fisher's exact test and continuous covariates were compared using the 2-tailed independent samples *t* test or Wilcoxon rank-sum test. We conducted a multivariable logistic regression analysis to identify patient factors associated with AFB.

To account for potential confounders, specifically nonrandom allocation to AFB, we collapsed all NAFB inflow procedures into 1 variable and matched patients based on propensity to undergo AFB and NAFB. Using logistic regression, we estimated the propensity as the probability of undergoing AFB. Models included baseline variables that were unbalanced between AFB and NAFB cohorts to the level of  $P < .10$  as well as variables that were deemed to be clinically significant and forced into the propensity score model (ie, chronic obstructive pulmonary disease, recent myocardial infarction, prior coronary intervention). No attempts were made to impute missing values. We then performed a propensity score-matched analysis of factors associated with the primary and secondary study outcomes. Statistical analyses were conducted using SAS, version 9.3.

### Results

Baseline characteristics for 1974 patients who underwent surgical treatment for claudication with AFB ( $n = 566$ ) and NAFB ( $n = 1408$ ) are reported in [Table 1](#). NAFB procedures included axillofemoral bypass (4.6%,  $n = 65$ ), femoral-femoral bypass (35.2%,  $n = 495$ ), iliofemoral bypass (9.3%,  $n = 131$ ), and isolated CFA endarterectomy (50.9%,  $n = 717$ ). Patients undergoing AFB tended to be

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