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Association between gender and outcomes of lower extremity peripheral vascular interventions

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Objective: **The purpose of this study was to evaluate the association of gender with outcomes of peripheral vascular intervention (PVI) for intermittent claudication and critical limb ischemia (CLI).**

Methods: **We reviewed 3338 patients (1316 [39%] women) undergoing PVI for claudication (1892; 57%) or CLI (1446; 43%) in the Vascular Study Group of New England from January 2010 to June 2012. Kaplan-Meier analysis, stratified by indication, was used to assess relationships between gender and the main outcome measures of major amputation, reintervention, and survival during the first year.**

Results: **Indications for PVI included claudication (n = 719 [38%] vs n = 1173 [62%]) and CLI (n = 597 [41%] vs n = 849 [59%]) in women and men, respectively ($P = .0028$). Women were older (69 vs 66 mean years; $P < .00001$), with less diabetes (43% vs 49%; $P = .01$), renal insufficiency (4.6% vs 7.3%; $P = .0029$), coronary artery disease (28% vs 35%; $P < .00001$), smoking (76% vs 86%; $P = .01$), and statin use (60% vs 64%; $P = .0058$). Technical success (95% vs 94%; $P = .11$), vascular injury (1.3% vs 1.0%; $P = .82$), and distal embolization (1.6% vs 1.3%; $P = .46$) were similar. Higher rates of hematoma (7.1% vs 3.4%; $P \leq .0001$) and access site occlusion (0.91% vs 0.24%; $P = .0085$) were observed in women compared with men. There were no differences in major amputation (0.6% vs 0.6%; $P = .81$) or mortality (2.1% vs 1.5%; $P = .20$) rates at 30 days between women and men. Reinterventions (surgical and percutaneous) were similar between genders for claudicants (log-rank test, $P = .75$) and CLI patients (log-rank test, $P = .93$). Major amputation rates during the first year were not different for women and men and with claudication (log-rank test, $P < .55$) or CLI (log-rank test, $P < .23$). One-year survival was not different between women and men with claudication (95% vs 96%; $P = .19$) or CLI (77% vs 79%; $P = .35$).**

Conclusions: **Whereas we observed higher rates of access site complications including hematoma and occlusion in women, we found no other evidence for gender disparity in reinterventions, major amputation, or survival rates after PVI for patients with claudication or CLI. (J Vasc Surg 2015;62:990-7.)**

Historically, women were thought to have a lower prevalence of cardiovascular disease relative to men. Although the awareness of coronary artery disease in women has grown in recent years as the result of epidemiologic research, public education campaigns, and physician education, the recognition of peripheral arterial disease (PAD) remains lacking in both men and women.[1] Whereas the gender-specific prevalence of PAD has not been conclusively defined, in total there are more women than men with PAD across the entire U.S. population.[1] In addition, it is now recognized that women experience the consequences of PAD at rates similar to those of men. This, taken together with the predominance of women relative to men in the aging population, warrants a better understanding of the risks faced by women who undergo treatment for peripheral vascular disease.[1]

Several studies have observed that women undergoing lower extremity revascularization tend to be older and to present with more advanced disease but with lower prevalence of other comorbidities, such as smoking.[1-3] Whereas there are no randomized controlled trials reporting gender-specific difference in endovascular revascularization, numerous studies have reported inferior results in selective outcomes in women. We have previously studied gender differences after infrainguinal bypass within the Vascular Study Group of New England (VSGNE).[4] This work showed similar postoperative morbidity with minor clinical differences in patency in the subgroup of women with critical limb ischemia (CLI) that did not translate into differences in limb salvage or survival.

The purpose of this study was to evaluate the association of gender with the procedural and 1-year outcomes of peripheral vascular intervention (PVI) for intermittent claudication and CLI within the VSGNE. The primary aims were to assess for gender differences in overall survival and major amputation rates within the first year.

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Secondary aims included an analysis of procedural technical details, complications, and 1-year reintervention rates. We hypothesized that the outcomes of PVI for lower extremity PAD were not appreciably different for women and men.

METHODS

Patients and database. From January 2010 to June 2013, 7307 patients who underwent PVI were entered into the VSGNE PVI registry. The VSGNE registry is a prospective, multi-institutional, regional quality assurance initiative that has been previously described.[5] The VSGNE PVI registry, initiated in 2010, includes procedures performed for lower extremity arterial occlusive disease of the aorta and iliac, femoral-popliteal, or infrapopliteal arteries or for peripheral aneurysms. The PVI registry records patient demographics, comorbidities, medications, procedure characteristics, and in-hospital complications. Outcomes including patency, ankle-brachial index, ambulation status, minor or major amputations, and reinterventions are recorded at 1-year follow-up.

Additional information is available at https://www.vascularweb.org/regionalgroups/vsgne/Pages/home.aspx. The data collection tool may be requested at http://www.vascularqualityinitiative.org/overview-benefits/procedures-collected/.

The study cohort consisted of patients undergoing procedures from January 2010 to June 2012 (Fig 1). In an attempt to standardize the type of disease of patients undergoing PVI for aneurysmal disease, acute ischemia or failing bypass grafts were excluded. Patients undergoing concomitant lower extremity bypass or having more than one PVI during the study period were excluded.

Definitions and outcome measures. More than 100 clinical and demographic data points were collected for each patient and prospectively entered into the VSGNE registry. These variables were defined by previously described definitions available at http://www.vascularqualityinitiative.org/about/procedures-collected. The indication for PVI is based on a hierarchy ranging from tissue loss to rest pain to claudication such that only one is recorded per limb. Technical details of the intervention recorded included procedural medications, access site, sheath size, TransAtlantic Inter-Society Consensus (TASC) classification, type of treatment, maximum balloon or stent size, use of closure device, and procedural complications. The diameter of the native artery treated is not recorded.

Our primary outcome measures were freedom from major amputation (defined as below or above the knee level) and overall survival during the first year, which were stratified by indication. We compared genders on various outcomes including type of peripheral intervention, postoperative complications, and percutaneous and surgical reintervention rates. Hematoma was classified as follows: (1) minor: visible or symptomatic hematoma requiring no treatment beyond compression; may require admission for observation; (2) moderate: hematoma requiring transfusion or thrombin injection; or (3) severe: bleeding requiring a return to the operating room. Complications requiring admission included medical and procedural complications but excluded planned admissions. Mortality was determined by matching patients with the Social Security Death Index.

Statistical analysis. Testing for normality was performed with the Shapiro-Wilk test. Continuous variables were compared with the *t*-test or Mann-Whitney test, as appropriate for normally and non-normally distributed data. Kruskal-Wallis test was used for ordered variables. Kaplan-Meier analysis evaluated relationships between gender and reintervention, freedom from major amputation, and overall survival during the first year, with the log-rank test used for statistical significance.

Statistical significance was expressed as a P value of $< .05$ or 95% confidence intervals where appropriate.

The use of de-identified data for this analysis without informed consent was approved by the Institutional Review Board of the University of Vermont College of Medicine.

RESULTS

Demographics. The study group included patients treated up to June 2013 to allow sufficient time for 1-year follow-up. To avoid potential confounding from multiple procedures, the study group was limited to those patients undergoing a single PVI (N = 3338) for claudication (n = 1892; 56.7%) or CLI (n = 1446; 43.4%) during this time (Fig 1). Of the 1446 patients treated for CLI, 165 patients suffered concomitant claudication in the contralateral limb. Patients were excluded if the indication for PVI was aneurysmal disease (n = 140) or acute ischemia (n = 367) or if they underwent concomitant infrainguinal or suprainguinal bypass (n = 159). An additional four procedures were excluded because of missing data.

Preoperative and operative characteristics by gender. At the time of revascularization, women on average were 3 years older (69 vs 66 mean years; $P < .00001$) and had less diabetes (43% vs 49%; $P = .004$), renal insufficiency (4.6% vs 7.3%; $P = .0029$), coronary artery disease (28% vs 35%; $P < .00001$), chronic obstructive pulmonary disease (25% vs 21%; $P = .007$), smoking (76% vs 86%; $P = .01$), beta-blocker use (69% vs 75%; $P = .00023$), and statin use (60% vs 64%; $P = .0058$; Table I). More women were at the extremes of low or high body mass index ($P < .00001$). Women were less likely to live at home preoperatively (96% vs 97%; $P = .045$) and to require assistance with ambulation (16% vs 12%; $P = .0016$). Fewer women had a previous lower extremity bypass (14.9% vs 18.5%; $P = .0069$). There was no difference between women and men in patients admitted before the procedure (20.0% vs 21.5%; $P = .30$).

Women were more likely to present with CLI. The indication for PVI in women was claudication (n = 791; 54.6%) and CLI (n = 597; 45.4%), whereas men presented with claudication (n = 1173; 58%) and CLI (n = 849; 42%; $P = .0028$). This difference was mainly due to a higher percentage of women presenting with rest pain, whereas the presentation of tissue loss was comparable between genders.