ORIGINAL RESEARCH

Sex Differences in Outcomes Following Endovascular Treatment for Symptomatic Peripheral Artery Disease: An Analysis From the K-VIS ELLA Registry

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Background**—**With advances in peripheral artery disease (PAD) treatments such as endovascular treatment (EVT), personalized patient assessment is important. Data on sex differences in clinical outcome for PAD patients undergoing EVT have been limited, and studies have produced conflicting results. This study sought to compare midterm clinical outcomes between women and men in a large population of patients with PAD undergoing EVT.

Methods and Results**—**The K-VIS ELLA (Korean Vascular Intervention Society Endovascular Therapy in Lower Limb Artery Disease) registry is a nationwide, multicenter, observational study that includes 3073 PAD patients undergoing EVT. The study population was divided into men (n=2523) and women (n=550). The primary outcome was a composite of death, myocardial infarction, and major amputation; the secondary outcome included major adverse limb events. Women had more comorbidities and more severe and complex target lesions than men. Women showed higher rates of death, myocardial infarction, or major amputation than men (14.8% versus 9.8%, adjusted hazard ratio 1.350, 95% CI 1.017-1.792, P=0.038), and higher rates of major adverse limb events (19.9% versus 14.5%, adjusted hazard ratio 1.301, 95% CI 1.014-1.670, P=0.039) and procedural complications (10.2% versus 5.9%, P<0.001) based on multivariable analysis. In patients with claudication, the primary outcome incidence was significantly higher in women (hazard ratio 2.088, 95% CI 1.421-3.068, P<0.001). In contrast, there was no significant difference in primary outcome for patients with critical limb ischemia between the 2 groups (hazard ratio 1.164, 95% CI 0.800-1.694, P=0.426). A significant interaction (P=0.035) between patient presentation and outcome was observed.

Conclusions**—**In a large population of patients with PAD undergoing EVT, women had higher rates of death, myocardial infarction, or major amputation than men and higher rates of complex lesions, procedural complications, and limb-specific adverse events. **(*J Am Heart Assoc*. 2019;8:e010849. DOI: 10.1161/JAHA.118.010849)**

Key Words: endovascular treatment • peripheral artery disease • outcomes • percutaneous transluminal angioplasty • sex

Cardiovascular disease is the leading cause of death worldwide, and there has been a rapid increase in the past decade in the prevalence of peripheral artery disease (PAD).[1] For the treatment of symptomatic PAD, endovascular treatment (EVT) has evolved with the development of new devices and techniques and is now recommended as the reasonable revascularization option in

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An accompanying Appendix S1 is available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.118.010849

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Clinical Perspective

What Is New?

- Among patients with peripheral artery disease undergoing endovascular therapy, women were on average older, with more complex lesion characteristics, higher rates of comorbidity, and higher rates of procedural complications than men.
- The cumulative incidences of 2-year cardiovascular and limb-specific adverse events were higher in women than in men, even after adjusting for baseline differences.
- These outcome differences were prominent in patients with claudication, but not in those with critical limb ischemia.

What Are the Clinical Implications?

- Physicians should be aware that procedural complications and prognosis may be worse among women with peripheral artery disease undergoing endovascular therapy than among men, particularly among those who present with claudication.

various clinical and anatomical situations by current guidelines.[2-4] There are well-established differences in the patterns of presentation, lesion characteristics, clinical outcomes, and response to therapy between male and female cardiovascular disease patients.[5-7] In particular, previous studies have demonstrated that women with coronary artery disease who undergo percutaneous coronary intervention are associated with higher rates of procedural complications and poorer outcomes than men.[8-11] These differences may be related to an older age of presentation, smaller vessel size, poorer overall health status, or a more severe anatomical disease burden at presentation in female patients. Similarly, several studies have evaluated the sex-related differences of outcomes in patients with PAD.[12-17] However, these studies have shown conflicting results with limited data on follow-up outcomes. Therefore, we sought to evaluate sex-related differences in presentation, disease severity, and procedural and midterm follow-up outcomes in PAD patients treated with EVT using a large-population, nationwide, multicenter, real-world registry.

Methods

The data, analytic methods, and study materials will not be made available to other researchers for purposes of reproducing the results or replicating the procedure.

Study Population and Data Collection

The K-VIS ELLA (Korean Vascular Intervention Society Endovascular Therapy in Lower Limb Artery Diseases) registry is a nationwide, multicenter, observational study (ClinicalTrials.gov NCT02748226). Between January 2006 and July 2015, a total of 3434 PAD patients (5097 target limbs) who were 20 years of age or older and treated with EVT in 31 hospitals in Korea were enrolled. The K-VIS ELLA registry study design and results have been described in detail previously.[18] A total of 3073 patients with 3972 target limbs were finally included in the current analysis after exclusion of 56 limbs with acute limb ischemia, 82 limbs with Buerger disease, 11 limbs lacking procedural or in-hospital data, 528 limbs lacking follow-up data after hospital discharge, and 448 limbs treated for repeat revascularization following the index procedure (Figure 1). Data on patient demographics, baseline clinical and lesion characteristics, medication history, clinical presentation, laboratory test results, treatments, and follow-up outcomes were collected from electronic medical records. Treatment strategy and medication were selected at the operator's discretion. The study protocol was approved by the institutional review board of each hospital and was conducted according to the principles of the Declaration of Helsinki. The institutional review boards of the participating hospitals waived the requirement of informed consent due to the retrospective nature of the study.

Definitions and Outcomes

PAD was defined as $\geq$50% luminal narrowing of a lower-extremity artery. Symptomatic lower-extremity ischemia was stratified into 6 categories according to the Rutherford classification.[19] Claudication was defined as Rutherford category 1, 2, or 3 diseases (mild, moderate, or severe claudication, respectively). Critical limb ischemia (CLI) was defined as Rutherford category 4, 5, or 6 diseases (ischemic resting pain, minor tissue loss, or major tissue loss, respectively). Target lesions were classified using the Trans-Atlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease.[4] Multilevel disease was defined as the presence of significant obstructive lesions at more than 1 level in the same limb (aortoiliac, femoropopliteal, and infrapopliteal arteries). Technical success was defined as evidence of successful revascularization with residual stenosis lower than 30% after angioplasty and absence of flow-limiting dissection or a hemodynamically significant translesion pressure gradient. A major amputation was defined as any lower extremity amputation through or proximal to the ankle joint; a minor amputation was defined as any lower extremity amputation distal to the ankle joint, including the foot or toe(s).

The primary outcome for the present study was a composite of all-cause mortality, myocardial infarction (MI), and major amputation. Secondary outcomes included major adverse limb events, defined as a composite of major amputation, minor amputation, and reintervention.

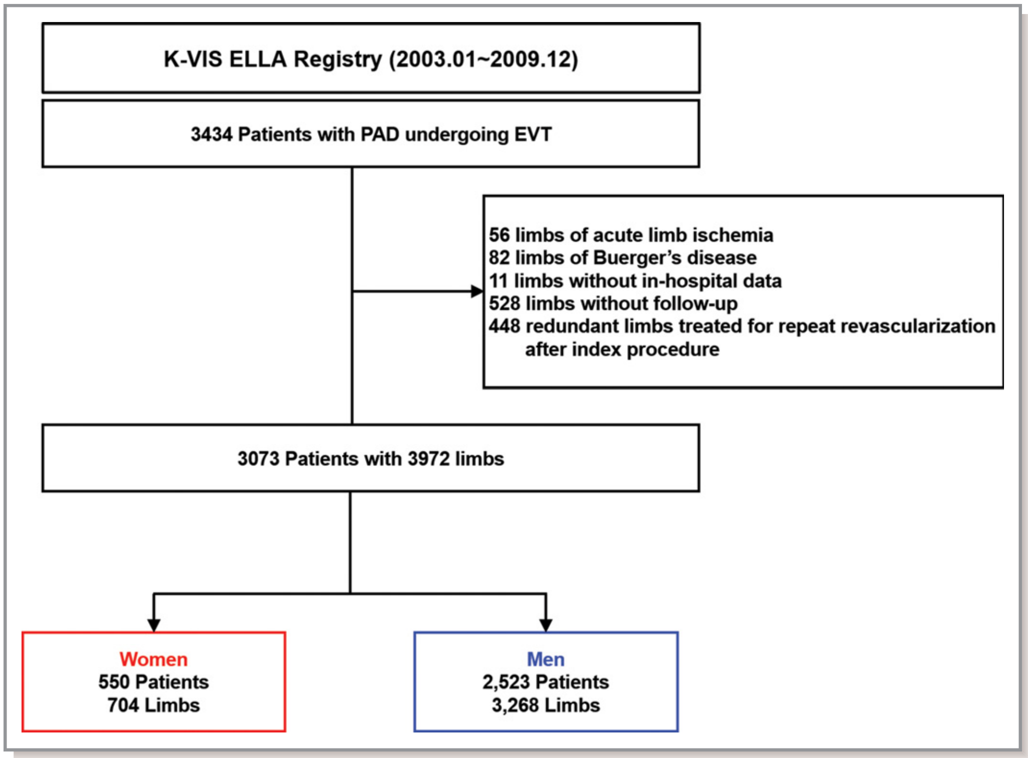

Figure 1. Study flow. EVT indicates endovascular treatment; K-VIS ELLA, Korean Vascular Intervention Society Endovascular Therapy in Lower Limb Artery Disease; PAD, peripheral artery disease.

Statistical Analyses

Continuous variables were compared using the Welch t test; categorical data were compared using the chi-squared test. Data were analyzed on a per-patient basis for clinical characteristics and on a per-lesion basis for the limb, lesion, or procedural characteristics. For per-limb or per-lesion comparison of characteristics, a generalized estimating equation was used to adjust intrasubject variability between limbs from the same patient. Cumulative incidences of clinical events were presented as Kaplan-Meier estimates and were compared using a log-rank test. Hazard ratio (HR) and 95% CIs were calculated using the Cox proportional hazards model to compare the risk of adverse events between male and female groups. In multivariable models, covariates suggested to be relevant with a $P<0.2$ in univariate analysis, or that were clinically relevant, were initially considered as candidate-independent predictors of clinical events. Adjusted HRs and 95% CIs for clinical outcomes according to sex were obtained using a final Cox regression that included age, hypertension, diabetes mellitus, chronic kidney disease, current smoking status, previous history of amputation, EVT, MI, stroke, bypass surgery, critical limb ischemia, multilevel disease, at least 1 Trans-Atlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease C or D, and body mass index >30 kg/m^2. All tests were 2-sided, and $P<0.05$ was considered statistically significant. Statistical analyses were performed using the R Statistical Software (version 3.4.0; R Foundation for Statistical Computing, Vienna, Austria).

Results

Clinical and Lesion Characteristics

Women comprised 18% of the study population. The mean age of the study population was 68.3±9.4 years. Baseline clinical characteristics and prescribed medications according to sex are described in Table 1. Female patients were older, with a higher body mass index, and had higher incidences of hypertension, diabetes mellitus, chronic kidney disease, and previous history of amputation and a lower incidence of current smoking. Men were more likely to have intermittent claudication symptoms, whereas women were more likely to present with CLI as an indication for EVT. Medications at discharge did not differ between the groups.

Sex-related differences in baseline lesion characteristics are described in Table 2. Women showed more target lesions with small vessels and were more likely to have multilevel diseases than men. Women also showed target lesions with greater percentage diameter stenosis, greater length, and a higher proportion of Trans-Atlantic Inter-Society Consensus for the

Table 1. Baseline Clinical Characteristics

	Women (n=550)	Men (n=2523)	*P* Value
Demographics			
Age, y	70.0±10.5	68.0±9.2	<0.001
Body mass index, kg/m^2	24.6±4.8	23.3±3.2	<0.001
Cardiovascular risk factors			
Current smoker	50 (9.1)	902 (35.8)	<0.001
Hypertension	432 (78.5)	1825 (72.3)	0.003
Diabetes mellitus	353 (64.2)	1430 (56.7)	0.001
Dyslipidemia	227 (41.3)	968 (38.4)	0.223
Chronic kidney disease	140 (25.5)	466 (18.5)	<0.001
Congestive heart failure	34 (6.2)	150 (5.9)	0.910
Previous history of MI	62 (11.3)	265 (10.5)	0.650
Previous history of stroke	81 (14.7)	373 (14.8)	>0.999
Previous history of bypass surgery	9 (1.6)	81 (3.2)	0.065
Previous history of amputation	52 (9.5)	142 (5.6)	0.001
Previous history of EVT	49 (8.9)	250 (9.9)	0.524
Presentation of PAD			
Rutherford classification			<0.001
1	47 (8.5)	300 (11.9)	
2	136 (24.7)	723 (28.7)	
3	123 (22.4)	708 (28.1)	
4	52 (9.5)	178 (7.1)	
5	118 (21.5)	389 (15.4)	
6	74 (13.5)	225 (8.9)	
Critical limb ischemia	244 (44.4)	792 (31.4)	<0.001
Medications at discharge			
Aspirin	471 (85.6)	2121 (84.1)	0.567
Clopidogrel	448 (81.5)	2074 (82.2)	0.917
Cilostazol	185 (33.6)	900 (35.7)	0.663
Warfarin	40 (7.3)	180 (7.1)	0.982
Renin-angiotensin receptor blocker	248 (45.1)	1118 (44.3)	0.928
β-blocker	205 (37.3)	846 (33.5)	0.231
Statin	381 (69.3)	1746 (69.2)	0.987
Calcium channel blocker	195 (35.5)	843 (33.4)	0.635
Diuretics	114 (20.7)	464 (18.4)	0.433

Data are presented as mean±standard deviation or n (%). EVT indicates endovascular treatment; MI, myocardial infarction; PAD, peripheral artery disease.

Management of Peripheral Arterial Disease C or D classifications. Pre- and postintervention ankle brachial indexes were significantly lower in women than in men (pre-EVT ankle brachial index, 0.62 versus 0.66, *P*=0.013; post-EVT ankle brachial index, 0.83 versus 0.88, *P*=0.002, respectively).

Table 2. Baseline Lesion and Procedural Characteristics

	Women (n=550)	Men (n=2523)	*P* Value
Lesion characteristics			
Number of target limbs	N=704	N=3268	
Involved vessel			
Aortoiliac	264 (37.5)	1688 (51.7)	<0.001
Femoral-popliteal	452 (64.2)	1787 (54.7)	<0.001
Infrapopliteal	318 (45.2)	1149 (35.2)	<0.001
Multilevel disease	294 (41.8)	1191 (36.4)	0.014
Pre-EVT ABI*	0.62±0.25	0.66±0.25	0.013
Post-EVT ABI†	0.83±0.22	0.88±0.21	0.002
In-stent restenosis	14 (2.0)	95 (2.9)	0.134
Total occlusion	388 (55.1)	1686 (51.6)	0.115
At least 1 TASC C or D	518 (73.6)	2202 (67.4)	0.002
Number of target lesions per limb	1.6±0.8	1.5±0.8	0.006
Diameter stenosis, %	90.4±11.3	89.3±12.0	0.036
Lesion length, mm	131.8±99.0	118.1±97.6	0.006
Procedural characteristics			
Total procedure number	N=1120	N=4856	
Successful EVT	637 (90.5)	2991 (91.5)	0.414
Treatment strategy			<0.001
Balloon only	620 (55.4)	2157 (44.4)	
Self-expandable stent	392 (35.0)	2166 (44.6)	
Balloon-expandable stent	67 (6.0)	421 (8.7)	
Others	41 (3.7)	112 (2.3)	
Balloon diameter, mm	4.5±1.7	5.1±1.9	<0.001
Balloon length, mm	88.9±61.9	77.0±56.7	<0.001
Stent diameter, mm	7.1±1.8	7.7±1.8	<0.001
Stent length, mm	77.3±34.2	74.7±33.4	0.182
Contrast volume, mL	171.9±94.1	176.9±102.0	0.297

Data are presented as mean±standard deviation or n (%). ABI indicates ankle-brachial index; EVT, endovascular treatment; TASC, Trans-Atlantic Inter-Society Consensus.
*Pre-EVT ABI was available in 2428 limbs (61.1%).
†Post-EVT ABI was available in 1635 limbs (41.2%).

Procedural Characteristics and Complications

Baseline procedural characteristics according to sex are shown in Table 2. Treatment strategies differed slightly between the female and male groups, with more women undergoing EVT with a balloon only and more men undergoing EVT with self-expandable stents. Furthermore, the average diameter of balloon or stent used was smaller in women than in men. However, use of contrast volume did not differ between the groups.

Total in-hospital procedural complications were more frequently observed in women than in men (10.2% versus 5.9%, *P*<0.001) (Figure 2). In particular, bleeding complications, access site complications, and vascular rupture occurred more commonly in women. However, in-hospital mortality, unexpected amputation or reintervention rates, and technical success rates were similar between these groups.

Follow-Up Clinical Outcomes

The median follow-up duration was 701 days (interquartile range 299-995 days). Compared with the male group, the women showed a significantly higher rates of all-cause death, MI, or major amputation (women versus men, 14.8% versus 9.8%, HR 1.706, 95% CI 1.345-2.163, *P*<0.001) (Table 3, Figure 3A). The rates of major adverse limb events was also significantly higher in women (19.9% versus 14.5%, HR 1.506, 95% CI 1.191-1.905, *P*<0.001) (Table 3, Figure 3B). After adjustment for baseline differences, sex-related differences showed similar trends in a composite of all-cause death, MI, or major amputation (14.8% versus 9.8%, adjusted HR 1.350, 95% CI 1.017-1.792, *P*=0.038) and in major adverse limb events (19.9% versus 14.5%, adjusted HR 1.301, 95% CI 1.014-1.670, *P*=0.039).

Independent Predictors of Primary Outcomes and Limb-Specific Adverse Events

On multivariable Cox regression model, female, CLI, chronic kidney disease, previous history of amputation, stroke, bypass surgery, and age were independent predictors of a composite of all-cause death, MI, or major amputation (Table 4). Independent predictors of limb-specific clinical events included female sex, CLI, chronic kidney disease, multilevel disease, Trans-Atlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease C or D lesions, and previous history of EVT (Table 4).

Sex Disparities According to Initial Presentation

To assess sex differences in clinical outcomes according to initial presentation, we analyzed data for patients who presented with CLI or claudication. Interestingly, among patients with CLI, there were no significant differences in primary outcome between men and women (17.8% versus 15.8%, HR 1.164, 95% CI 0.800-1.694, *P*=0.426) (Figure 4A). However, among patients with claudication, women showed significantly higher cumulative incidences of primary outcome than men (13.2% versus 7.0%, HR 2.088, 95% CI 1.421-3.068, *P*<0.001) (Figure 4B). There was a significant interaction (*P*=0.035) between sex and initial presentation on the primary

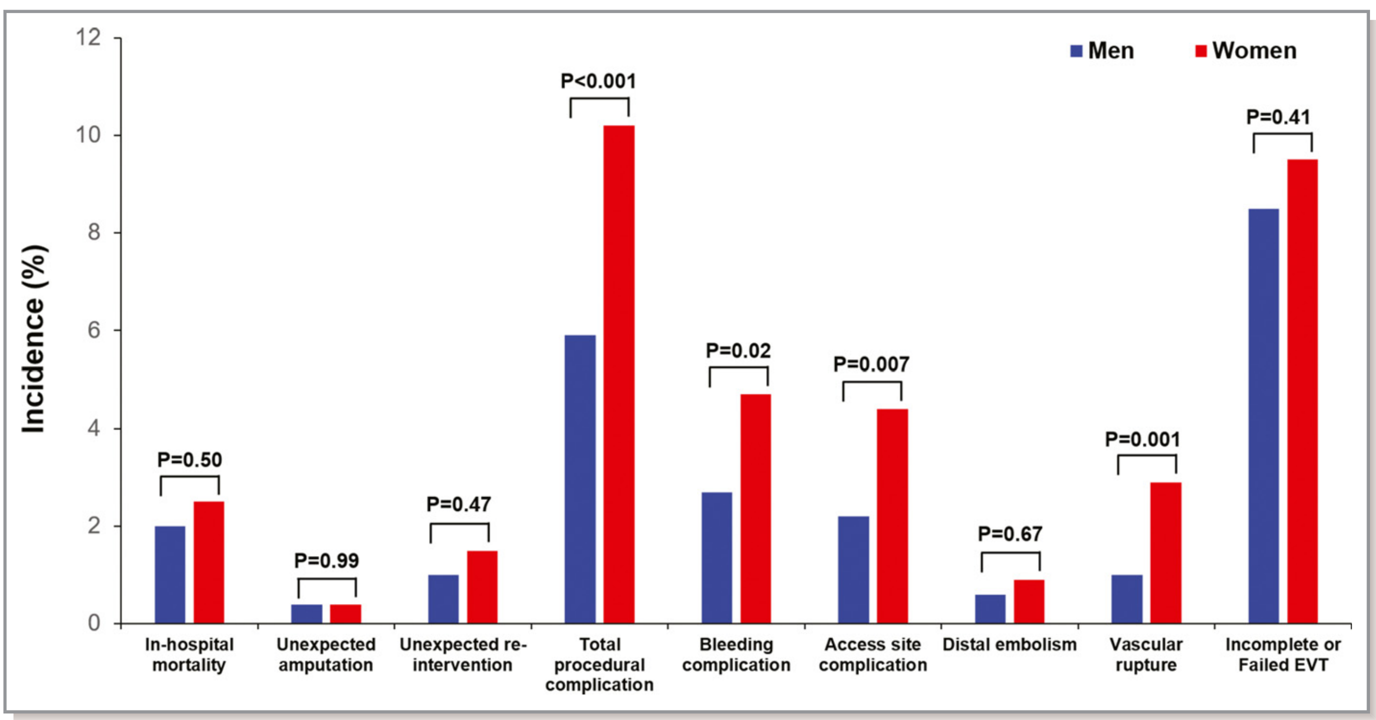

Figure 2. In-hospital outcomes and procedural complication rates according to sex. Crude incidences of in-hospital mortality, unexpected amputation, unexpected reintervention, total procedural complication, bleeding, access site complication, distal embolism, vascular rupture, and failed or incomplete procedure for men (blue bar) and women (red bar). EVT indicates endovascular treatment.

Table 3. Two-Year Clinical Outcomes Among Patients With Peripheral Artery Disease According to Sex Disparity

	Event Rates		Unadjusted		Adjusted*	
	Women (n=550)	Men (n=2523)	HR (95% CI)	*P* Value	HR (95% CI)	*P* Value
Death, MI, or major amputation	90 (14.8)	270 (9.8)	1.706 (1.345-2.163)	<0.001	1.350 (1.017-1.792)	0.038
All-cause death	54 (9.8)	175 (6.9)	1.474 (1.086-2.000)	0.013	1.203 (0.874-1.656)	0.256
Myocardial infarction	8 (1.8)	18 (1.0)	2.140 (0.931-4.923)	0.073	1.925 (0.790-4.687)	0.149
Major amputation	17 (3.1)	30 (1.2)	2.685 (1.481-4.868)	0.001	1.666 (0.884-3.141)	0.115
Minor amputation	27 (4.9)	78 (3.1)	1.646 (1.062-2.549)	0.026	1.146 (0.730-1.800)	0.554
Total amputation	44 (8.0)	102 (4.0)	2.068 (1.452-2.945)	<0.001	1.410 (0.975-2.039)	0.068
Reintervention	57 (10.4)	217 (8.6)	1.280 (0.956-1.713)	0.098	1.279 (0.936-1.748)	0.123
Major adverse limb event†	91 (19.9)	298 (14.5)	1.506 (1.191-1.905)	<0.001	1.301 (1.014-1.670)	0.039

Event rate values are n (%). Cumulative incidence of events was presented as Kaplan-Meier estimates. EVT indicates endovascular treatment; HR, hazard ratio; MI, myocardial infarction; TASC, Trans-Atlantic Inter-Society Consensus.

*Adjusted variables included age, hypertension, diabetes mellitus, chronic kidney disease, current smoking, previous history of amputation, EVT, MI, stroke, bypass surgery, critical limb ischemia, multilevel disease, at least 1 TASC C or D, and body mass index >30 kg/m^2.

†Major adverse limb event (MALE) was defined as major amputation, minor amputation, or reintervention.

outcome, which consisted of all-cause death, MI, and major amputation.

Discussion

In the present study we investigated sex-related disparities in clinical outcomes for PAD patients undergoing EVT. The major findings were as follows: first, among EVT-treated PAD patients, women were on average older than men, with more complex lesion characteristics and higher rates of comorbidities. Second, women also had higher rates of procedural complications, including bleeding, access site complication, and vascular rupture. Third, cumulative incidences of 2-year follow-up cardiovascular and limb-specific adverse events were significantly higher in women than in men, even after adjustment for baseline differences. Finally, women were associated with higher risk of adverse events in patients presented with claudication compared with men, but there was no significant difference of outcomes between the groups in patients with CLI.

Numerous studies have evaluated sex or gender differences in cardiovascular disease, and these studies have consistently shown differences in patterns of presentation, lesion characteristics, clinical outcomes, and responses to

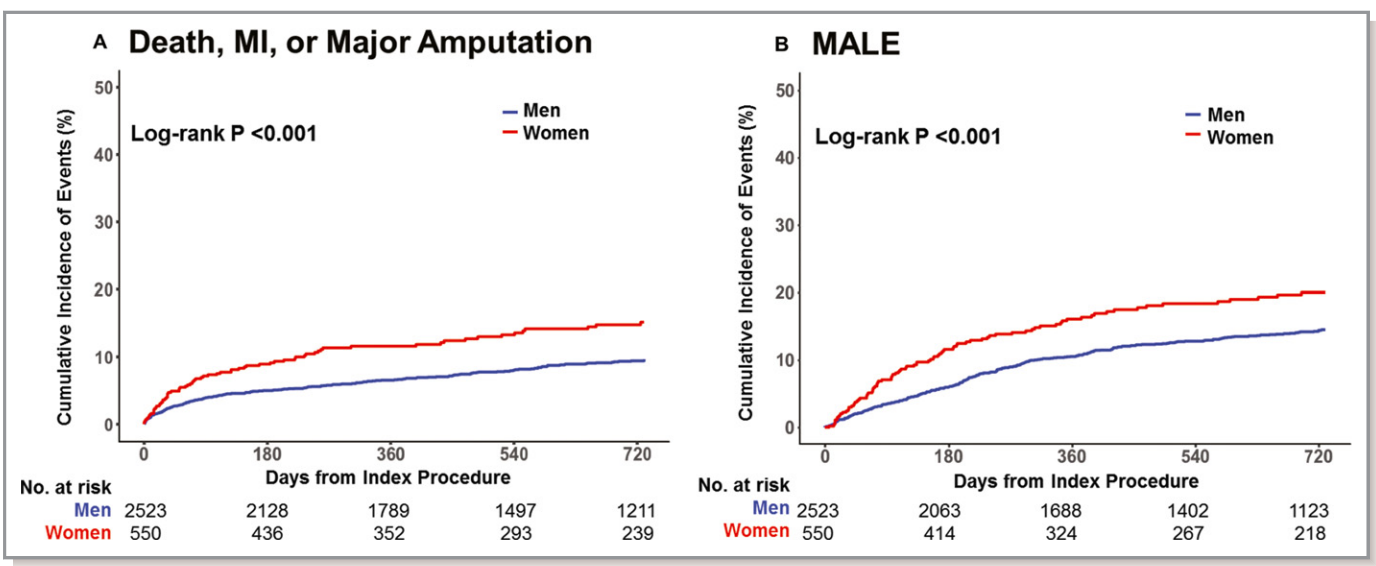

Figure 3. Comparison of 2-year clinical outcomes according to sex disparity. Kaplan-Meier curves for comparison of rates of death, MI, or major amputation (**A**), and MALE (**B**) for men (blue lines) and women (red lines). MALE indicates major adverse limb event; MI, myocardial infarction.

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Table 4. Independent Predictors of Clinical Events in Patients With Peripheral Artery Disease Undergoing EVT

Variable	Adjusted HR (95% CI)*	*P* Value
Death, MI or major amputation		
Female	1.302 (1.015-1.670)	0.038
Critical limb ischemia	1.469 (1.117-1.933)	0.006
Chronic kidney disease	3.667 (2.824-4.760)	<0.001
Previous history of amputation	1.612 (1.113-2.336)	0.011
Previous history of stroke	1.400 (1.050-1.867)	0.022
Previous history of bypass surgery	2.188 (1.262-3.791)	0.005
Age (per 1 increase)	1.040 (1.026-1.055)	<0.001
Major adverse limb event		
Female	1.301 (1.014-1.670)	0.039
Critical limb ischemia	1.875 (1.491-2.358)	<0.001
Chronic kidney disease	1.554 (1.227-1.968)	<0.001
Multilevel disease	1.474 (1.196-1.815)	<0.001
At least 1 TASC C or D	1.734 (1.308-2.297)	<0.001
Previous history of EVT	1.736 (1.304-2.313)	<0.001

EVT indicates endovascular treatment; HR, hazard ratio; MI, myocardial infarction; TASC, Trans-Atlantic Inter-Society Consensus.
*C-index of the Cox regression model of death or amputation and major adverse limb event were 0.741 (95% CI 0.706-0.776) and 0.713 (95% CI 0.684-0.742), respectively.

therapy.[20-22] These differences may arise from differences in biology, termed "sex differences," or from differences in sociocultural behavior, termed "gender differences." Understanding sex disparities is important in making proper diagnoses and delivering optimal treatments for patients with cardiovascular disease. Therefore, we sought to compare baseline clinical characteristics, lesion characteristics, procedural outcomes, and follow-up outcomes between men and women with PAD who underwent EVT. As with previous studies,[12-14] we found that women were older at the time of presentation and were less likely to be smokers. Furthermore, our study showed that women had more severe lesion complexity at the time of revascularization and underwent EVT more frequently for CLI than did men. Although the etiology of these differences is unclear, factors such as smaller vessel size, less physical activity, smaller calf muscle mass, higher proportion of asymptomatic disease, and more comorbidities including arthritis or osteoporosis in women may have contributed to the delay in detection of PAD in women.[23-27] Another possibility is that the development of disease in women may be delayed.

In our cohort, women with PAD tended to have higher rates of procedural complications such as bleeding, access site complication, and vascular rupture after EVT. This finding is consistent with previous studies.[12,14,27] Factors such as smaller blood vessel diameter, greater incidence of femoropopliteal or infrapopliteal disease, and higher rates of multilevel disease at presentation may contribute to the higher incidence of procedural complications after EVT in women. However, the rates of in-hospital mortality and procedural success rates were not significantly different between women and men, despite a higher incidence of procedural complications in women. These seemingly contradictory findings may reflect the fact that most procedural

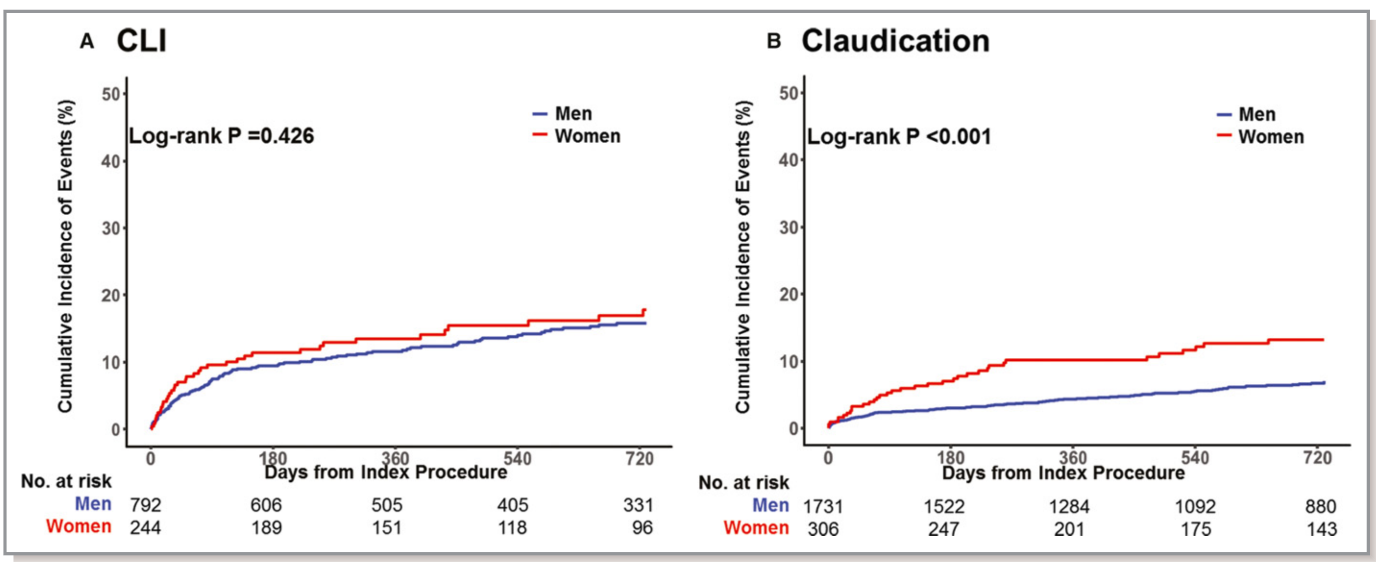

Figure 4. Differential rates of primary outcome between men and women according to initial presentation. Kaplan-Meier curves for comparison of rates of a composite of all-cause death, MI, and major amputation between men (blue line) and women (red line) with CLI (**A**) or claudication (**B**). Interaction *P*-value for primary outcome and initial presentation (CLI vs claudication) was significant (*P*=0.035). CLI indicates critical limb ischemia; MI, myocardial infarction.

complications are treatable and nonfatal. Although numerous studies have assessed the association of sex and in-hospital outcomes in PAD patients treated with EVT using large registry data, most studies have lacked extensive data on follow-up clinical outcomes and have produced conflicting results. The largest study, based on data from 3 states in United States, showed that mortality rates for women undergoing surgical intervention for peripheral artery disease were substantially higher than those for men, even after adjustment for comorbidities.[27] In addition, the primary or secondary patency of stents following EVT was poorer in women than in men.[15,28] In contrast, Hussain et al reported no significant sex difference in risk of follow-up all-cause mortality or major amputation occurring in patients seen by a vascular surgeon rather than patients undergoing surgical or endovascular intervention.[16] In the present study women had significantly higher rates of 2-year cardiovascular composite outcomes, which consist of all-cause mortality, myocardial infarction, and major amputation, as well as limb-specific adverse events than men, even after adjustment for confounding factors.

Ferranti et al reported no evidence of gender disparity in reinterventions, major amputation, or survival rates following EVT for patients with claudication or CLI despite higher rates of access site complications in women.[14] However, McCoach et al showed women with CLI to be associated with higher rates of major adverse cardiovascular events despite similar rates of limb salvage.[29] In the present study the results suggest that sex-related outcomes may differ according to their clinical presentation. Women with claudication had a higher incidence of cardiovascular adverse events (Rutherford classification 1, 2, or 3) than men with claudication, but there was no significant difference in outcome between women and men with CLI (Rutherford classification 4, 5, or 6). According to the current guidelines, revascularization should be performed in CLI patients to minimize tissue loss.[2-4] However, in patients with intermittent claudication, revascularization for a large-vessel (aortoiliac) short-length lesion was recommended only for class IA indications. This suggests that the risk-benefit tradeoff for revascularization should be considered for patients with intermittent claudication with small-vessel PAD. Our study showed that women have smaller vessel size, a higher proportion of femoropopliteal or infrapopliteal disease, multilevel disease, and a greater incidence of complications than men. We think that these differences may have contributed to the significantly higher incidence of 2-year cardiovascular adverse events in female patients with intermittent claudication undergoing EVT. In this regard, physicians should be aware that procedural complications and prognosis may be poorer when they are treating female patients with PAD undergoing EVT compared with male patients, especially when the patient presents with claudication. Future studies based on larger registry data sets and longer-term follow-up data would be helpful to confirm our results.

Study Limitations

The present study had several limitations. First, because of the retrospective nature of the study, residual or unmeasured confounding factors could have influenced the results, even after multivariable analysis. In particular, choice of treatment was based on the physician's discretion. Second, the current study could be potentially underpowered for evaluating sex differences because of the relatively small sample size for women. Nevertheless, our data showed statistically significant differences in outcomes between women and men, and total population was modest in size. Third, our results cannot be extrapolated to patients with PAD who did not receive EVT because our registry did not include PAD patients treated with surgical intervention or medical therapy alone.

Conclusions

Among a large population of patients with PAD who underwent EVT, women had higher rates of complex lesions, procedural complications, death, MI, major amputation, and limb-specific adverse events than men. These differences were particularly pronounced in patients with claudication; however, no sex disparity was observed in patients with CLI. A future large observational study is warranted to confirm these results.

Disclosures

None.

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SUPPLEMENTAL MATERIAL

Appendix

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