Impact of body mass index and gender on wound complications after lower extremity arterial surgery

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ABSTRACT

Objective: Wound complications (WCs) after lower extremity arterial surgery (LEAS) are common, resulting in readmissions and reinterventions. Whereas diabetes and obesity are known risk factors for WCs, gender-specific variability in body fat distribution (android vs gynoid) may drive differential risks of WCs after LEAS. We analyzed the independent and synergistic effects of gender and body mass index (BMI) on WCs.

Methods: We performed a retrospective review of prospectively collected data from a published, randomized, multicenter trial assessing the incidence of WCs (dehiscence, surgical site infections, seroma, and hematoma) after LEAS. Postoperative outcomes were compared between genders. A multivariable regression model assessed the impact of gender and BMI on WCs. Subanalysis focused on the synergy of gender and body habitus, groin-only incisions, and clinical outcomes.

Results: There were 502 patients who underwent LEAS between October 2010 and September 2013. The cohort was elderly (67.6 ± 10.5 years), mostly male (72%), and overweight (BMI, 27.6 ± 5.7); 225 (45%) patients had a groin-only incision. In 171 patients (37.9%), a WC developed within 30 days, 85% of which were infectious in etiology. On multivariable regression, obesity (odds ratio [OR], 2.10; 95% confidence interval [CI], 1.17-3.77), morbid obesity (OR, 2.87; 95% CI, 1.32-6.23), and female gender (OR, 1.17; 95% CI, 1.06-2.75) were independent predictors of infectious WCs at 30 days. When stratified by groin-only incision, BMI was no longer significant, but female gender (OR, 2.70; 95% CI, 1.24-5.87) was predictive of infectious WCs at 30 days. There was no synergistic effect of BMI and gender on WCs.

Conclusions: WCs are common after LEAS. BMI is an independent risk factor for the development of any WC. Female gender, a potential surrogate for high hip to waist ratio body habitus, is also an independent predictor of groin WCs, suggesting the clinical importance of gynoid vs android fat distribution. (J Vasc Surg 2017;■:1-6.)

Wound complications (WCs) after lower extremity arterial surgery (LEAS) are common. These complications include superficial and deep surgical site infections (SSIs), dehiscence, seromas, lymphoceles, and hematomas. The incidence of WCs after lower extremity bypass procedures ranges from 11% to 44%, depending on the series.[1-4]

This complication poses a critical problem as it leads to increased readmission and reintervention rates, driving increased overall health care expenditures.[5,6] This problem is compounded by the increased scrutiny that outcome and quality measures face in the current health care arena. Health care institutions face serious financial penalties for such complications as well as their associated readmissions.[5] At the patient level, SSIs have also been shown to be negatively associated with pain scores and quality of life.[7]

A number of factors are associated with increased risk of WCs and SSIs, including diabetes mellitus, active tobacco use, and obesity.[4,8] Specifically, body mass index (BMI) has been investigated in this regard with equivocal results as an "obesity paradox," whereby being overweight can counterintuitively be protective of WCs, exists.[4,9-13] Women also appear to be at an increased risk of WCs among other complications after vascular surgery; however, the interaction between BMI and gender is not well established.[4,14]

Body fat distribution (android vs gynoid), which is related to both gender and body weight, is arguably a more powerful estimator of morbidity than BMI and thus may drive differential risks of WCs.[15] Women may therefore carry an increased risk of WCs after LEAS because they are more likely than men to have an endomorph body habitus with a large hip to waist ratio and subcutaneous fat. As such, gender may compound the effects of BMI on WCs. The location of the incision is an additional factor that may interplay with gender, BMI, and body habitus. The purpose of this study was to analyze the independent and synergistic effects of gender and BMI on WCs after LEAS.

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METHODS

This study is a retrospective review of prospectively collected data from a randomized, multicenter trial that assessed the incidence of WCs after the application of silver alginate dressings in elective LEAS.[3] From October 2010 until September 2013, adult patients who were undergoing an elective operation for peripheral vascular disease that would require at least one incision below the inguinal canal were offered participation in the trial.[3] Of note, the results from that trial were neutral, namely, there was no difference between silver dressings and conventional dressings with regard to WCs, which permitted the entire cohort from that trial to be used as a pooled analysis for this study.

Several demographic and preoperative metrics were collected, including age, gender, BMI, cardiovascular comorbidities, and indication for surgery. Specific operative variables included the surgical sites, type of material used for arterial reconstruction (autogenous, homograft, prosthetic), and estimated blood loss. In categorizing surgical site, groin refers to either direct femoral reconstruction (ie, endarterectomy) or femoral vessel exposure for an endovascular aneurysm repair (EVAR). Suprainguinal inflow refers to the groin incision that was necessary for an aortobifemoral, axillofemoral, or similar inflow operation. Postoperative complications were identified at various time points and included WCs, myocardial infarction, stroke, and the need for a WC-related readmission. WCs were defined as infectious (dehiscence, superficial SSI, or deep SSI) and noninfectious (hematoma, seroma, lymphocele).

Continuous variables were analyzed using Student *t*-test, and categorical variables were analyzed using two-sided χ^2 tests (Fisher exact test for cell counts <5). After selection of clinically meaningful variables, a multivariable logistic regression was created to identify independent predictors of WCs. Secondary analysis assessed the synergy of gender and body habitus as well as identified independent predictors of WCs for those patients who had groin-only incisions (includes the following surgical sites: groin, suprainguinal inflow, and femoral-femoral bypass). Statistical analysis was performed using Stata 14.1 software (StataCorp LP, College Station, Tex). The necessary Institutional Review Board approval was obtained for this study; informed consent of the patient was unnecessary for this retrospective study and thus not obtained.

RESULTS

During the trial period, 502 patients underwent elective LEAS that included at least one infrainguinal incision. The overall cohort was composed of primarily elderly (67.6 ± 10.5 years), male (n = 363 [72%]), white (n = 420 [84%]), and overweight (BMI, 27.6 ± 5.7) patients who suffered from the typical cardiovascular comorbidities of hypertension (n = 447 [89%]) and diabetes mellitus (n = 223 [44.4%]). Stratifying the cohort by gender, women were significantly older (69.6 ± 1.9 years vs 66.8 ± 1.1 years; $P = .001$) and were more likely to suffer from diabetes mellitus (n = 73 [52%] vs n = 150 [41.3%]; $P = .015$) compared with men. There was no difference in BMI between men and women (27.8 ± 0.6 vs 26.9 ± 0.9; $P = .11$; Table I).

Table I. Preoperative characteristics

Variable	Male (n = 363)	Female (n = 139)	*P* value
Age, years, average (SD)	66.8 (10.0)	69.6 (11.6)	.001
Race			.590
White	306 (84.3)	114 (82)	
Black	44 (12.1)	18 (13)	
Hispanic	10 (2.8)	7 (5)	
Native American	1 (0.3)	0 (0)	
Pacific Islander	2 (0.6)	0 (0)	
BMI, average (SD)	27.8 (5.7)	26.9 (5.7)	.110
BMI class			.260
Underweight (<18.5)	11 (3)	6 (4.3)	
Normal (18.5-24.9)	107 (29.5)	51 (36.7)	
Overweight (25-29.9)	135 (37.2)	41 (29.5)	
Obese (30-34.9)	72 (19.8)	31 (22.3)	
Morbidly obese (>35)	38 (10.5)	10 (7.2)	
Diabetes mellitus	150 (41.3)	73 (52)	.015
Hypertension	321 (88.4)	126 (90.7)	.477
Previous myocardial infarction	85 (23.4)	31 (22.3)	.791
Previous stroke	34 (9.4)	21 (15.1)	.965
Renal insufficiency	23 (6)	13 (9.3)	.102
Indication			.001
Claudication	127 (35)	30 (21.6)	
Rest pain	50 (13.8)	23 (6.6)	
Tissue loss	85 (23.4)	51 (36.7)	
EVAR	42 (11.6)	16 (11.5)	
Bypass revision	25 (6.9)	8 (5.8)	
Peripheral aneurysm	21 (5.8)	1 (0.7)	
Other	13 (3.6)	10 (7.2)	

BMI, Body mass index; *EVAR*, endovascular aneurysm repair; *SD*, standard deviation.
Values are reported as number (%) unless otherwise indicated.

With regard to the indication for surgery, a subset of patients (n = 58 [11.6%]) had a groin incision as an adjunct to EVAR. The remaining patients (n = 444 [88.4%]) had lower extremity surgery related to occlusive (claudication, rest pain, or tissue loss) or aneurysmal disease. Women were more likely than men to present with tissue loss (n = 51 [36.7%] vs n = 85 [23.4%]; $P = .003$; Table I).

Nearly half of the patients in the series had a lower extremity bypass procedure (n = 239 [47.6%]), typically