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Impact of Preoperative Anemia in Patients Undergoing Peripheral Vascular Intervention

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Table. Risk factors and outcomes

Pt. No.	Age; sex	Risk factor	Procedure	MV duration, hours		ICU, days	FEV₁, %	EMG: right; left	
				Postoperative	Total			Baseline	Follow-up
1	60; M	Former smoker	TAAA repair	17.5	30.5	4	NA	NA; weak	NA; good
2	76; M	Former smoker; sleep studies with poor oxygen saturation	Ruptured TAAA repair	12	20	6	NA	NA; weak	NA; good
3	81; M	Former smoker; COPD	Mycotic TAAA repair	16.5	25.5	2	NA	NA; weak	NA; good
4	75; F	Former smoker; COPD	Ruptured TAAA repair	8	16	10	1.68	NA; weak	NA; good
5	61; F	Active smoker; COPD	TAAA repair	24	36	5	1.55	NA; nearly absent	NA; good
6	66; M	Active smoker; COPD	RVD	19 + 44	23 + 44	6	2.38	Nearly absent; nearly absent	Good; good
7	79; F	Former smoker	TAAA repair	63	73	5	1.29	NA; absent	NA; weak

COPD, Chronic obstructive pulmonary disease; *EMG,* electromyogram; *F,* female; *FEV₁,* forced expiratory volume in 1 second; *ICU,* intensive care unit; *M,* male; *MV,* mechanical ventilation; *NA,* not applicable; *Pt. No.,* patient number; *RVD,* renal/visceral debranching; *TAAA,* thoracoabdominal aortic aneurysm.

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Opioid Usage After Lower Extremity Amputation and Discharge Prescribing Recommendations

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Objective: Opioids are commonly used for pain control after lower extremity amputations, including below-the-knee amputations (BKAs) and above-the-knee amputations (AKAs). Well-defined benchmarks for discharge prescription requirements after amputation are deficient. We evaluated opioid usage after amputation to identify high-risk patients and provide recommendations for posthospitalization opioid prescriptions at discharge.

Methods: Patients who had undergone lower extremity amputations from 2008 to 2016 were selected from the Cerner's HealthFacts database using the International Classification of Diseases, 9th and 10th revisions, diagnosis and procedure codes. The patient demographics, disease severity, and other comorbidities were evaluated. The opioid medications used during the hospital stay were identified from the data and converted to the opioid oral morphine milligram equivalent per day (MME/d) for evaluation and comparison. We used t tests for statistical analysis.

Results: A total of 2400 patients who had undergone AKA or BKA were evaluated (63.4% male, 67.3% white, 41.7% married, and 58.0% with a Charlson comorbidity index >3). The average length of stay was 5.72 ± 3.56 days. The patients who had had a significantly greater MME/d in the early postoperative period included those undergoing a BKA (61.5 vs 55.4; $P = .007$), men (62.6 vs 54.0; $P < .0001$), white patients (64.3 vs 44.67; $P < .0001$), younger patients (age <60 years, 69.6 vs 54.0; $P < .0001$), and patients treated at nontraining institutions (66.7 vs 56.7; $P < .0001$). Patients staying >6 days had increased opioid usage, likely secondary to complications (Fig). The mean MME/d used on postoperative day 1 was 59.5 ± 52.2 and had decreased to a mean MME/d before discharge of 17.6 ± 17.9.

Conclusions: The present analysis has demonstrated that younger patients, white men, those undergoing BKAs, and those treated at nontraining institutions had greater opioid usage during the hospital stay. At discharge, the patients had used an average of 17.6 MME/d, which equates to only three hydrocodone/acetaminophen 5/325 mg Tablets daily. These findings have shown that vascular surgeons are likely overprescribing opioids at discharge and must be cognizant of the appropriate dosing quantities. Prescriptions at discharge should reflect this daily usage and be tapered to avoid chronic usage, overdose, and possible death.
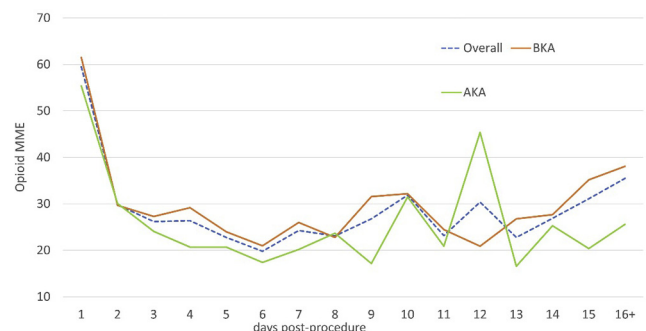

Fig. Postprocedure opioid morphine milligram equivalent (MME) usage. *AKA,* Above-the-knee amputation; *BKA,* below-the-knee amputation.

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Impact of Preoperative Anemia in Patients Undergoing Peripheral Vascular Intervention

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Objective: The Vascular Quality Initiative database was analyzed to determine whether preoperative anemia is associated with postoperative death, length of stay (LOS), and overall survival for patients undergoing peripheral vascular intervention (PVI).

Methods: The national Vascular Quality Initiative database was queried for all PVIs performed between 2010 and 2019, and the outcomes were correlated with the presence of anemia. Anemia was classified as mild (10-13 g/dL for men and 10-12 g/dL for women), moderate (8-9.9 g/dL), and severe (<8 g/dL) using the World Health Organization definition of anemia. Analysis of variance or the Kruskal-Wallis test was used for continuous variables and the χ^2 test for categorical variables. Multivariate logistic regression, generalized linear regression, and proportional Cox models were used to evaluate the association between preoperative anemia and postoperative 30-day mortality, total LOS, and overall survival time. A Kaplan-Meier curve was used to compare the survival time according to anemia severity.

Results: A total of 86,726 patients met the inclusion criteria. The demographics recorded included age (mean, 68 years), gender (59% male), and race (80% white). Anemia was documented in 41,627 patients (48%) and was mild in 29,687 (71%), moderate in 10,500 (25%), and severe in 1440 (4%). Demographics (age, gender, race) and comorbidities (smoking,

Table. Univariate and multivariate analyses for overall survival, 30-day mortality, and total length of hospital stay

Predictor	Univariate			Multivariate		
	HR	95% CI	*P* value	HR	95% CI	*P* value
Overall survival						
Normal hemoglobin	1	NA	NA	1	NA	NA
Mild anemia	2.23	2.16-2.31	**<.001**	1.50	1.44-1.57	**<.001**
Moderate anemia	3.53	3.39-3.67	**<.001**	2.02	1.91- 2.13	**<.001**
Severe anemia	3.50	3.21-3.82	**<.001**	2.14	1.76-2.24	**<.001**
30-Day mortality	**OR**	**95% CI**	*P* value	**OR**	**95% CI**	*P* value
Normal hemoglobin	1	NA	NA	1	NA	
Mild anemia	3.08	2.71-3.51	**<.001**	2.20	1.90-2.54	**<.001**
Moderate anemia	6.79	5.93-7.79	**<.001**	3.39	3.30-4.52	**<.001**
Severe anemia	8.20	6.41-10.38	**<.001**	3.94	3.11-5.35	**<.001**
Total LOS	**IRR**	**95% CI**	*P* value	**IRR**	**95% CI**	*P* value
Normal hemoglobin	1	NA	NA	1	NA	NA
Mild anemia	2.01	1.96-2.06	**<.001**	1.68	1.64-1.73	**<.001**
Moderate anemia	4.33	4.18-4.48	**<.001**	3.10	2.97-3.23	**<.001**
Severe anemia	5.97	5.48-6.51	**<.001**	4.98	4.50-5.54	**<.001**

CI, Confidence interval; *HR*, hazard ratio; *IRR*, incidence rate ratio; *LOS*, length of stay; *NA*, not applicable; *OR*, odds ratio.
Boldface *P* values represent statistical significance.

body mass index, hypertension, chronic obstructive pulmonary disease, congestive heart failure, and a requirement for dialysis) were associated with the degree of preoperative anemia. The median follow-up was 4 years (range, 1.25-5.78 years). On univariate analysis, 30-day mortality, total LOS, and overall survival were significantly associated with the level of preoperative anemia (Table). These associations persisted in the multivariate models (Table). Kaplan-Meier survival was also associated with the degree of anemia ($P < .001$; Fig).

Conclusions: The presence and degree of preoperative anemia was independently associated with 30-day mortality, total LOS, and overall survival for patients undergoing PVI. The presence and degree of anemia should be important components of preoperative risk stratification for patients undergoing PVI. Anemia should be a listed variable in all reports detailing the outcomes of PVI.
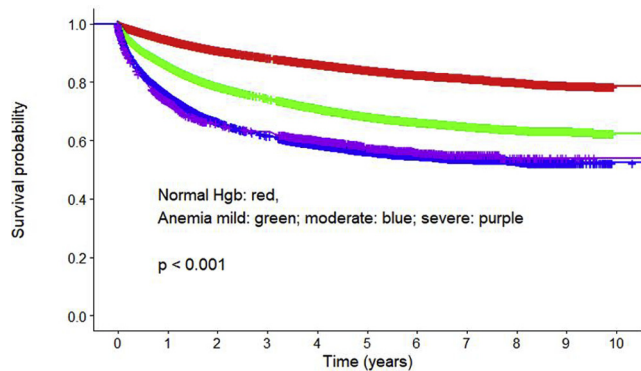
Fig. Kaplan-Meier curves comparing survival time stratified by anemia severity. *Hgb,* Hemoglobin.

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Predictors of Amputation-free Survival After Endovascular Intervention for Chronic Limb-threatening Ischemia

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Objective: Chronic limb-threatening (CLTI) is associated with 25% limb loss and 25% mortality at 1 year. Lethality increases to 45% if the patient requires a major amputation. Percutaneous peripheral intervention constitutes a less morbid treatment option for patients with CLTI. We assessed amputation-free survival (AFS) in a contemporary cohort treated with endovascular recanalization and assessed its predictors.

Methods: Patients with CLTI who had undergone endovascular revascularization at a single regional hospital from 2015 to 2019 were reviewed. The baseline demographic characteristics, wound, ischemia, and foot infection (WIfI) stage, treatment strategies, and long-term outcomes were tabulated. AFS was defined as freedom from major limb amputation or death from any cause and was the primary endpoint of our study. $P < .05$ was used for univariate screening and inclusion in a multivariable model. The results are presented as the mean ± standard error of the mean.

Results: A total of 137 limbs in 111 patients were studied. The comorbidities included diabetes (65%), congestive heart failure (21%), and dialysis dependence (18%). Most limbs had presented with advanced wounds (WIfI stage 3-4, 66%; Rutherford category 6, 47%). The interventions performed were most often targeted femoropopliteal disease (69%), although 26% were multilevel. Percutaneous atherectomy, stenting, and paclitaxel-coated or -eluting devices were used in 68%, 28%, and 15% of cases, respectively. After a median follow-up of 16 months (interquartile range, 4-29 months), the 12-month primary patency was 87.4% ± 1.6%; however, only 59.1% ± 0.9% of the patients were alive with their revascularized limb intact (Fig). Using multivariate analysis, the significant predictors of reduced AFS included non−white race (hazard ratio, 2.96;