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Authors
Teng, Alexandra E
Kennedy, Kevin F
Parikh, Rushi V
et al.

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Temporal Trends and Outcomes of Peripheral Artery Disease Revascularization and Amputation Among the HIV Population

Alexandra E. TENG, MD[1], **Kevin F. KENNEDY, MS**[2], **Rushi V. PARIKH, MD, FACC, FSCAI**[3], **Ehrin J. ARMSTRONG, MD, MSc, MAS, FACC, FSCAI, FSVM**[4], **Priscilla Y HSUE, MD, FACC**[5], **Eric A. SECEMSKY, MD, MSc, RPVI, FACC, FSCAI, FSVM**[6]

[1]Division of Cardiology, Department of Medicine, University of California, San Francisco

[2]Department of Biostatistics, St. Luke's Health System, Kansas City

[3]Division of Cardiology, Department of Medicine, University of California, Los Angeles

[4]Division of Cardiology, Department of Medicine, Adventist Heart and Vascular Institute, St. Helena

[5]Division of Cardiology, Department of Medicine, Zuckerberg San Francisco General Hospital

[6]Division of Cardiology, Department of Medicine, Beth Israel Deaconess Medical Center

Abstract

Objective—With antiretroviral therapy, people living with HIV (PLWH) are developing age-related diseases, including peripheral arterial disease (PAD). This study examined frequency and outcomes of peripheral vascular intervention (PVI) and primary amputation in PLWH.

Design—We used the National Inpatient Sample (NIS) database to examine demographics, comorbidities, and temporal trends among PVI and primary amputation admissions by HIV status from 2012–2018.

Methods—Inverse probability of treatment weighting was used to calculate adjusted odds of in-hospital death and amputation. Cost of hospitalization and length of stay were compared by HIV status and revascularization approach.

Results—Of 347,824 hospitalizations for PVI/amputation, 0.6% were PLWH, which was stable over time. PLWH had more renal and hepatic disease, whereas uninfected individuals had more traditional PAD risk factors. 55.2% of HIV+ admissions were endovascular compared to 49.3% in HIV− admissions, and 28.9% of the HIV+ admissions were elective compared to 42.1% among

Corresponding Author: Eric A. Secemsky, MD, MSc, Beth Israel Deaconess Medical Center, Division of Cardiology, Department of Medicine, 375 Longwood Avenue, Suite 440, Boston, MA 02215, Phone: (617) 632-7701, Fax: (617) 632-7620, esecemsk@bidmc.harvard.edu.

Disclosures
Eric Secemsky consults for Abbott, Bayer, BD, Boston Scientific, Cook, CSI, Inari, Janssen, Medtronic, Philips, and VentureMed unrelated to this work. Priscilla Hsue has received honoraria from Gilead and Merck unrelated to this work and grant support from Novartis unrelated to this work. Ehrin Armstrong serves as a consultant for Abbott Vascular, Boston Scientific, Cardiovascular Systems, Gore, Medtronic, Philips, and Shockwave Medical unrelated to this work. Rushi Parikh, Kevin Kennedy, and Alexandra Teng have no conflicts of interest to disclose.

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HIV−. HIV status did not impact amputation following PVI. In-hospital death was similar between groups following PVI or primary amputation. PLWH had lower costs of hospitalization and a trend towards shorter hospital stays.

Conclusion—Although PLWH are developing more age-related chronic illnesses, the number of PAD-associated procedures has remained flat. Despite being younger with fewer traditional PAD risk factors, PLWH had higher rates of unplanned PVI admissions and endovascular revascularization but similar in-hospital outcomes. These findings suggest PLWH have different risk factors for PAD and are likely underdiagnosed and undertreated, while those who are treated have similar outcomes to the general population.

Keywords

Peripheral arterial disease; peripheral vascular intervention; HIV-associated cardiovascular disease; amputation

Introduction

The lifespan of people living with HIV (PLWH) on contemporary antiretroviral therapy (ART) is rapidly approaching that of the general population. [1] Consequently, by the year 2030, it is estimated that 73% of HIV-infected persons will be aged 50 or older, and as such, will be developing more age-related chronic illnesses, including cardiovascular disease (CVD). [2] Prior studies have shown that PLWH are at increased risk for the full spectrum of CVD [3], including cardiac death [4], acute myocardial infarction [5], stroke [6], and heart failure with both reduced and preserved ejection fraction. [7] This excess risk, even despite viral suppression, is likely multifactorial, including chronic inflammation and immune dysregulation, increased traditional risk factors, ART-related dyslipidemia, access to care, and behavioral factors. [8] Furthermore, prior work has shown that although the excess risk of vascular disease among PLWH compared to the general population is primarily among the younger age strata, overall vascular events in both groups increase with age. [9] It follows, therefore, that as the HIV population life expectancy increases, so would the prevalence of these age-related illnesses.

The overall prevalence of PAD in the United States (US) among adults over 40 years of age is estimated to be 7%, but this is based on data from the late 1990s to early 2000s. [10] A more recent systematic review published in 2013 using data from 2000–2010 found a significant rise in PAD by 13.1% in high income countries, including the US. [11] Despite the overall rise in PAD in the US and the established elevated risk of CVD among PLWH, there are limited data with regard to the impact of peripheral arterial disease (PAD) in the HIV population. Prior studies performed looking at PLWH and PAD have been limited by sample size and generalizability and relied on ankle-brachial index to define PAD, which has not been validated in the HIV population. [3] The results from these studies have been inconsistent with prevalence of PAD ranging from 2% to 30%. [9, 12–20] The largest study to date examined the veteran population and identified PLWH to have significantly higher rates of incident PAD events (11.9 PAD events per 1,000 person-years, compared to uninfected individuals a HR 1.19; 95% CI, 1.13, 1.25), most pronounced among those with high viral loads and low CD4 counts. There was a reported 30% increased risk of PAD associated with HIV status. Mortality rates following PAD diagnosis were high for both groups, but as high as 50% at 5 years from PAD diagnosis in the poorly controlled HIV+ group, suggesting the need for aggressive treatment of both HIV and PAD in this population. [14] These data, however, incompletely examined the use of peripheral vascular intervention (PVI) for PAD and the associated outcomes among PLWH.

Further data are needed to better understand how PLWH with concomitant PAD are currently being managed and the outcomes associated with PVI. Therefore, we used data from the National Inpatient Sample (NIS) database, the largest publicly accessible all-payer inpatient database, to study three objectives. First, we sought to characterize admissions for lower extremity PVI and major amputation, stratified by HIV status. Second, we sought to evaluate differences in outcomes following PVI between those with and without HIV infection. Finally, we aimed to calculate the hospital costs and length of stay associated with these hospitalizations.

Methods

Data Source

We obtained data from the NIS database between 1 January 2012 and 31 December 2018. The NIS is distributed as part of the Healthcare Cost and Utilization Project (HCUP) by the Agency for Healthcare Research and Quality (AHRQ). It represents a 20% stratified sample of all discharges from US hospitals across 47 states, accounting for 97% of the US population and over 36 million hospitalizations each year. The database captures over 100 clinical characteristics, including patient demographics, hospital characteristics, principal diagnosis and up to 24 secondary diagnosis codes and 15 procedure codes using the International Classification of Diseases (ICD), discharge status and disposition, total hospitalization charges, and length of stay. The data used in this analysis is managed and distributed by HCUP. In order to retain the largest amount of information from the original sources while also maintaining consistency among sources, HCUP has developed coding practices when entering data from different hospitals into the database to capture baseline characteristics, diagnoses, and outcomes. Outside of sociodemographics, which have negligible missing data, we consider the absence of a claim code as absence of the condition. Of note, 1 October 2015 represents the year in which the US transitioned from using the ninth revision to the tenth revision of ICD codes. This data source was deemed not to qualify as human subjects research and therefore did not require approval from the Institutional Review Board at Beth Israel Deaconess Medical Center.

Study Population

For this study, we identified all adult hospitalizations (aged ≥ 18 years) between 1 January 2012 and 31 December 2018 that were associated with a procedure code corresponding to lower extremity PVI, including those who underwent endovascular, surgical, or both surgical and endovascular (hybrid) approaches. The list of procedure codes used to ascertain patients who underwent PVI is provided in Supplemental Digital Content 1, Appendix 1. All PVI-related admissions were then stratified into two groups based on the presence of a diagnostic code for HIV. In an effort to also capture those with more advanced PAD, hospitalizations with a procedural code for a major lower extremity amputation without a concomitant procedural code for PVI were collected and presumed to represent those who underwent primary amputation. Amputations for reasons unrelated to PAD, including those with concomitant diagnostic codes for pressure or venous ulcers, trauma, or lower extremity malignancy, were excluded. The list of ICD diagnostic and procedure codes used to define HIV status, major amputation, and these exclusions are listed in Supplemental Digital Content 1, Appendix 1.

Patient, Hospitalization, and Institutional Characteristics

Patient sociodemographics included age (years), sex, race, metropolitan versus urban location (based on county population size), and median household income (based on national quartile for patient zipcode). Chronic conditions were derived from the 29 Elixhauser comorbidities provided by AHRQ, in addition to several HIV and cardiovascular-specific comorbidities (HCV, claudication, chronic limb ischemia, prior amputation, tobacco use, ischemic heart disease, ischemic stroke, and transient ischemic attack). As data from the NIS is derived from hospital admission and discharge documentation, these comorbidities are assumed to have predated or were diagnosed at the time of the admission. Diagnostic codes used to identify patients with these additional comorbidities are listed in Supplemental Digital Content 1, Appendix 1. Hospitalization characteristics included type of PVI (endovascular, surgical, or hybrid), length of stay (days), and cost of admission using cost-charge ratios. Institutional characteristics included size (based on bed size), metropolitan characteristics (urban defined as counties surrounding metro areas of >/= 1 million population), ownership (private non-profit, private for profit, government), teaching status, and region.

Study Outcomes

For the first objective, the primary outcome was the number of hospital admissions for PVI and amputation in the HIV-positive versus HIV-negative groups. We analyzed temporal changes in these percentages over the study period and differences in hospital and patient characteristics. For the second objective, the primary outcomes were in-hospital mortality and lower extremity amputation among patients admitted for PVI and in-hospital mortality among patients admitted for primary amputation. For the third objective, the primary outcomes were length of hospital stay and costs of admission.

Statistical Analysis

Descriptive statistics focused on frequencies and proportions for categorical variables. We compared continuous variables using a linear trend test and reported them as medians and ranges. We compared categorical variables using the Mantel-Haenszel trend test and reported them as counts and percentages. Time point data were examined annually to identify temporal changes.

Given the significantly larger number of HIV-negative cases, we performed inverse probability treatment weighting (IPTW) to balance the differences between HIV-positive and HIV-negative groups. Propensity score (PS)-based weights used in the IPTW model were derived from a logistic regression model predicting the likelihood of having HIV.

This model included all baseline characteristics, including patient demographics, hospital characteristics, and patient comorbidities listed in Tables 1 and 2. Patients who were HIV positive were assigned a weight of 1/PS and those who were HIV negative a weight of 1/(1-PS). A proportional distribution of baseline covariates was assessed for effect size, and a standardized difference (SD) of 0.10 or less was considered a statistically good balance between the two groups. After modeling was complete, a generalized estimating equation model was used to estimate the magnitude of statistical significance for in-hospital mortality and amputation following PVI in HIV versus non-HIV, expressed with odds ratios and 95% CI.

For calculating overall hospital costs, costs from all years were adjusted to account for inflation and were reported in terms of "2018 dollars."

We considered a 2-sided *P* value < 0.05 to be significant. We performed the statistical analyses using SAS, version 9.4 (SAS Institute).

Results

Over the study period, there were 347,824 hospitalizations for lower extremity PVI or amputation. Of these, 1,945 (0.6%) were among HIV-infected individuals. Among the HIV-positive group, 21.2% (N=412) underwent surgical revascularization, 55.2% (N=1,074) underwent endovascular revascularization, 5.9% (N=115) underwent hybrid surgical and endovascular revascularization, and 17.7% (344) underwent primary amputation. A higher proportion of patients in the HIV-negative group underwent surgical revascularization (N=93,070, 26.9%), whereas 49.3% (N=170,532) underwent an endovascular approach, 6.2% (N=21,481) underwent a hybrid approach, and 17.6% (N=60,796) underwent primary amputation. (Fig. 1) During the study period, the overall number of inpatient admissions for PVI and amputation remained stable with the only difference occurring between 2015 and 2016, which corresponds with the change from the ICD 9 to the ICD 10 coding system. The numbers remained stable over time within each ICD coding system. Among the PVI and primary amputation admissions, there was no change in the overall proportion of HIV-positive individuals undergoing revascularization or amputation procedures (Fig. 2). Furthermore, there was no temporal change in revascularization strategy (endovascular or surgical). Among admissions for HIV-infected individuals, only 28.9% were elective, whereas 42.1% of admissions were elective among the HIV-uninfected group. Missing data with regard to age, gender, race, income, hospital county size, elective admission, length of stay, and hospital cost were negligible.

Patient, Procedural and Hospital Characteristics

Patients in both groups admitted for revascularization procedures or amputation were more likely to be male, yet the proportion was larger among PLWH. Compared with the HIV-negative group, patients in the HIV-positive group were younger, predominantly black, and of lower socioeconomic status. The HIV-positive group had a high burden of comorbidities, including HCV, renal failure, liver disease, anemia, coagulopathy, and drug abuse. The uninfected group, on the other hand, had a higher burden of traditional cardiovascular risk factors, including diabetes, obesity, and ischemic heart disease. Tobacco use was similar between groups but modestly more frequent in the HIV-positive group. Those with HIV were less likely to carry a diagnosis of critical limb ischemia (CLI) or claudication, but there was no significant difference in rates of prior amputation. (Table 1, Fig. 1)

The primary amputation subgroup had higher acuity presentations with only 25% of the HIV-positive and 30.2% of the HIV-negative groups admitted electively. Likewise, 34.6% of the HIV-positive and 44.4% of the HIV-negative amputation only admissions also carried the diagnostic code for CLI. (See Supplemental Digital Content 2, Appendix 2, which includes tables of the characteristics and outcomes of the primary amputation group by HIV status)

For hospital characteristics, admissions among the HIV-positive group tended to occur more frequently in large (64.1% HIV+ v 60.3% HIV−), urban (49.8% HIV+ v 27.6% HIV−), teaching (79.7% HIV+ v 69.7% HIV−) hospitals that were predominantly in the southern US (52.4%). (Table 2)

In-Hospital Mortality and Amputation

Unadjusted rates of amputation following PVI were similar among patients with HIV versus without HIV, while in-hospital death occurred less frequently among PLWH (amputation: 133 (8.3%) HIV+ and 23,769 (8.3%) HIV−, p=0.962; in-hospital death: 32 (2.0%) HIV+ and 8,537 (3.0%) HIV−, p=0.019). After weighting, there was no association between HIV status and either amputation (odds ratio [OR] 0.97, CI 0.71–1.34, p=0.874) or in-hospital death (OR 0.70, CI 0.48–1.03, p=0.068). Among the HIV-positive group, there was no difference in mortality or subsequent amputation stratified by revascularization strategy (surgical or hybrid approaches compared to endovascular).

In the primary amputation group, death occurred in 4.4% among PLWH and 3.7% among those without HIV. There was no association between HIV status and in-hospital mortality following primary amputation after weighting (OR 1.09, CI 0.61–1.95, p=0.772).

Length of Stay and Cost of Hospitalization

In the PVI group, PLWH had a trend towards shorter lengths of stay compared with those without HIV. While the median length of stay was 6 days in the HIV+ group and 5 days in the HIV− group, after adjustment for baseline characteristics, the average LOS was actually 0.35 days ± 0.38 days shorter in the HIV+ group (p=0.068). PLWH also had statistically significant lower total hospitalization costs (average hospital cost $3,417 ± $2,195 lower in the HIV+ group compared to the HIV− group, p=0.002). Compared with an endovascular approach, a surgical approach was associated with a trend towards lower cost of hospitalization and length of stay in both groups, with lower cost reaching statistical significance in the HIV-negative group.

Conversely, among those who underwent primary amputation, PLWH had longer lengths of hospitalizations (average LOS 2.45 days ±1.29 days longer in the HIV+ group, p=0.001) and higher total costs (average cost of hospitalization $9,207 ± $4,277 higher in the HIV + group, p-0.001) compared to with those without HIV. Missing data for length of stay and cost of hospitalization were negligible.

Discussion

This NIS-based study analyzed 286,684 hospitalizations in the US for lower extremity revascularization procedures and 61,140 hospitalizations for major lower extremity primary amputations, totaling 347,824 PAD-related procedures between 2012 and 2018. We found that the overall proportion of inpatient revascularization procedures and amputations being performed among the HIV-positive group was 0.6%, and that this proportion did not significantly change over the six-year study period despite the overall trend of PLWH living longer and developing more age-related chronic illnesses. Notably, comorbidity patterns differed between those with and without HIV, including more liver disease, renal disease and substance abuse in the HIV population, and more traditional cardiovascular comorbidities in the non-HIV population. Those with HIV were less likely to carry the diagnosis of critical limb ischemia but were more likely to be admitted on a non-elective basis. We also observed that of those who underwent revascularization, the PLWH group was more likely to have an endovascular as opposed to surgical approach. Even with these differences in mind, the rates of amputation and mortality did not differ between groups. The PLWH group was associated with a trend towards shorter hospital stays and statistically significant lower costs of hospitalizations.

PAD in general is known to be an underdiagnosed condition [21], and once it has been diagnosed, it is associated with high risk of mortality and readmission. As Beckman et al demonstrated, incident PAD among the HIV population is significantly higher than that of the general population, and in those with poorly controlled HIV, the mortality rates are as high as 50%. [14, 22] Interestingly, this study and others have demonstrated that the rate of PVIs in the general population has been stable [23] (Supplemental Digital Content 3, Appendix 4 shows the temporal trend of PVI and amputation by revascularization strategy in the HIV-negative group, and Appendix 5 demonstrates the flat overall temporal trend of admissions for both the HIV-positive and HIV-negative groups combined). However, given increased lifespan in the HIV population, known increased incidence of vascular disease with aging, and previously demonstrated excess risk of PAD among PLWH, it would be expected that increased PVIs in this population would follow. To the contrary, our study demonstrated the curve of inpatient revascularization procedures and amputation among PLWH has remained flat. While this could indicate that HIV is not an independent risk factor for PAD, these findings may further support underdiagnosis and undertreatment of PAD in the HIV population. As seen in this analysis, PLWH had more non-traditional risk factors for developing PAD, which could result in decreased screening efforts anchored on traditional comorbidities like coronary artery disease and diabetes. This hints towards a different mechanism of PAD among the HIV-infected population and highlights that different criteria should be established to trigger screening for PAD among those with HIV.

While the flat temporal trend of PVI among PLWH is suggestive of underdiagnosis and undertreatment, our cohort was comprised of those who were successfully diagnosed and treated. Interestingly, despite higher rates of non-elective admissions and high-risk comorbidities in the PLWH group, overall costs of hospitalization did not differ irrespective of revascularization strategy, and there was a trend towards shorter lengths of stay among PLWH. This cannot be attributed to differences in revascularization strategy, because although the PLWH group was more likely to undergo an endovascular approach, there were no significant differences in amputation, mortality, cost, or length of stay compared with a surgical approach. This may in part be explained by the fact that the HIV-positive group was more likely to be admitted to large, urban, academic hospitals, where there is more procedural and peri-procedural experience. Regardless, despite HIV-infected individuals carrying a higher burden of chronic illnesses, these data suggest that HIV infection itself should not influence PAD revascularization strategy and that among those treated with PVI, HIV status is not associated with higher healthcare costs. When PAD is diagnosed later in its course requiring up front amputation, however, there is excess cost and length of stay associated with PLWH.

Our study has several limitations. First, the NIS database does not identify individual patients, so there is no longitudinal information available, resulting in an analysis that is limited to outcomes at the time of discharge from the index hospitalization. Second, patients with multiple admissions for repeat revascularization or for subsequent amputation are counted as new incidents. This means our primary amputation group represents a group that did not undergo PVI on the studied admission but cannot rule out a recent prior admission for PVI that then subsequently required amputation. Third, in the NIS database many concomitant diagnoses are not coded for on any given admission, which can explain inconsistencies such as a lower than expected percentage of primary amputation patients without a diagnostic code for CLI. Excluding patients with diagnostic codes for conditions other than CLI that would result in amputation was an attempt to make the group more specific for PAD. Fourth, the NIS does not include laboratory values, and so we were unable to stratify procedures and outcomes based on HIV-specific variables, including CD4 count and viral load. Finally, our study population only includes inpatient hospitalizations and therefore does not capture many of the outpatient endovascular PVIs. Another study using Medicare data similarly demonstrated the annual rate of PVIs performed over time has remained relatively flat in the general population (401.4 to 419.6 PVIs per 100,000 Medicare beneficiaries, p=0.17), but also demonstrated a significant shift towards outpatient PVIs from 2006 to 2011 (inpatient PVI rate 209.7 to 151.6 per 100,000, p<0.001). [23] This limitation likely exaggerates the proportion of surgical versus endovascular revascularization. It may also contribute to the explanation in the seemingly lack of rise in PVIs over time seen in this study. Our study population only includes those who underwent inpatient surgery or PVI and fails to capture both extremes, including patients too sick to be offered any intervention as well as outpatient endovascular procedures.

Overall, the proportion of PVI procedures and amputations in PLWH has not increased despite prior data suggesting PLWH are living longer, developing more chronic illnesses, and have an increased incidence of PAD. Our study implies there may be a component of underdiagnosis and undertreatment of PAD in this population, and that there are likely different associated PAD risk factors specific to the HIV population. We also demonstrate that if appropriately diagnosed and revascularization is indicated, there is no increased risk of in-hospital death, amputation, or length of stay between the HIV-positive and HIV-negative groups. Furthermore, despite more comorbidities, cost of hospitalization is lower among PLWH. Even in more acute cases requiring primary amputation, the rate of mortality is similar between groups, but length of hospital stay and cost of hospitalization are significantly greater in the HIV-positive group. Therefore, further work is needed to better understand the mechanism and risks of PAD in the HIV population in order to allow for earlier diagnosis and treatment in this high risk group.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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All listed authors have made substantial contributions to this research and manuscript to fulfill authorship criteria, including participation in study design, data analysis, and manuscript content and review. The statistical analysis was performed by Kevin Kennedy. All authors have read and approved the submitted manuscript.

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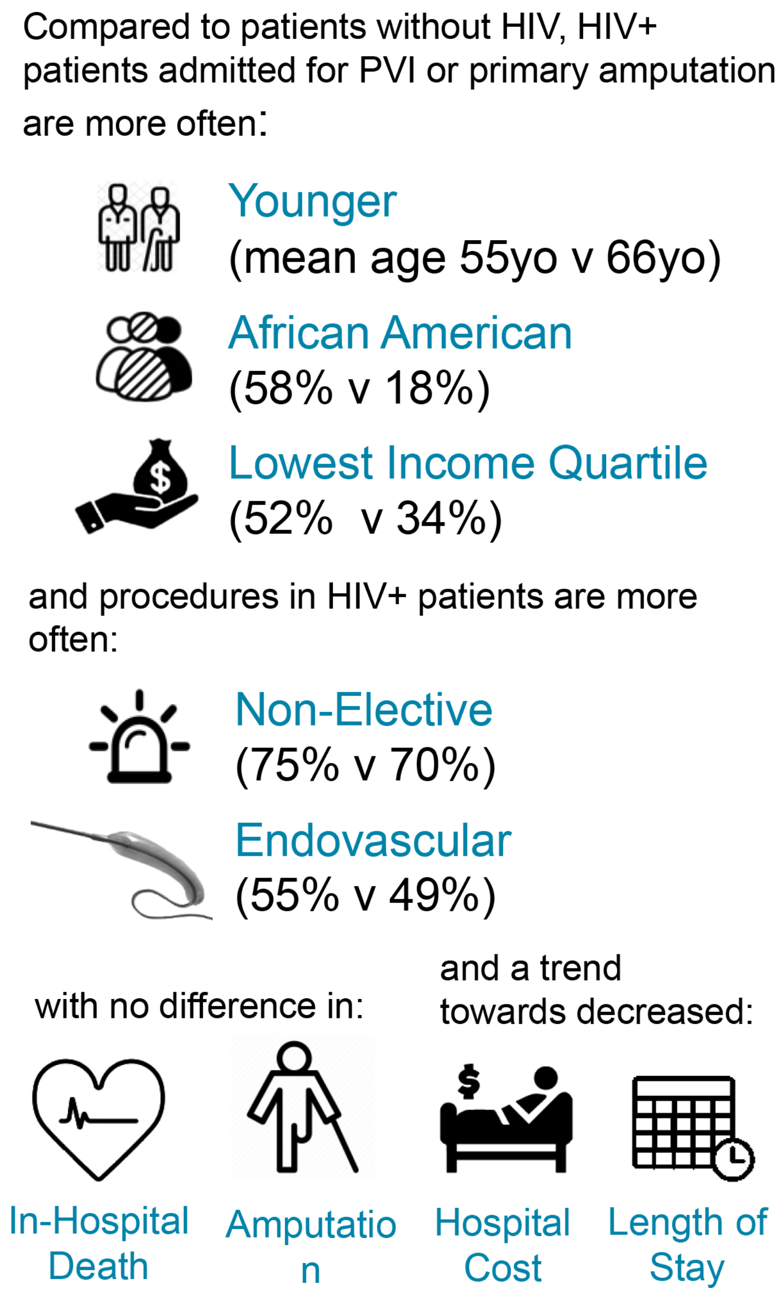

Fig. 1.
Overview of characteristics and outcomes of inpatient admissions for peripheral vascular intervention (PVI) or primary amputation from 2012–2018 by HIV status.

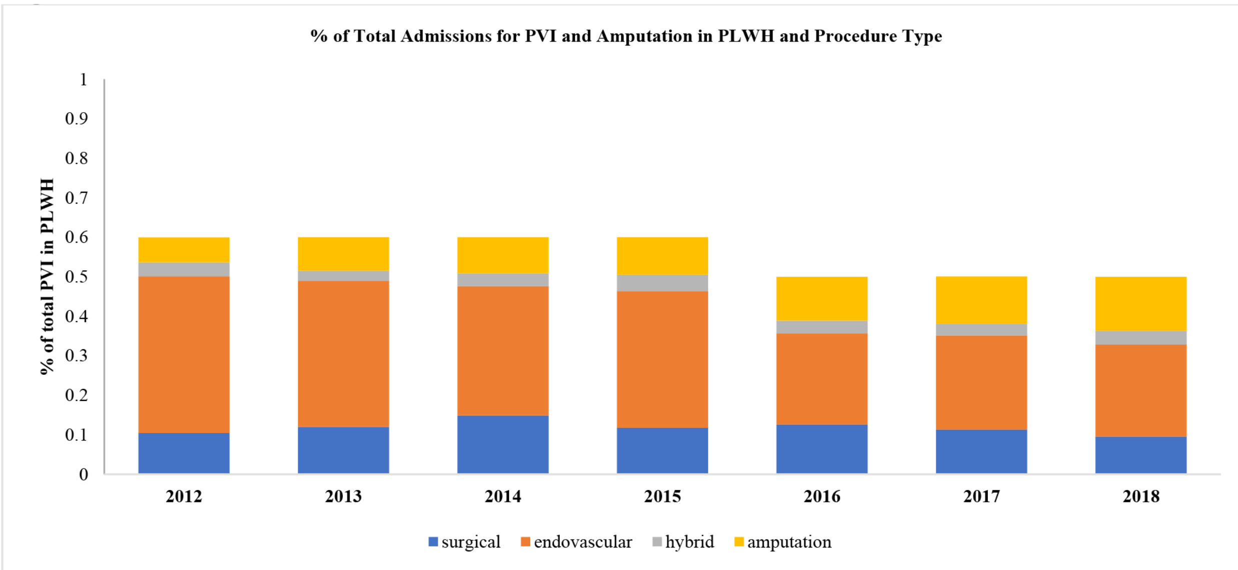

Fig. 2.

Temporal change in proportion of overall peripheral vascular interventions (PVI) and primary amputations performed in people living with HIV (PLWH) by year and procedure type.

PVI=peripheral vascular intervention, PLWH=people living with HIV

Table 1.

PVI and Primary Amputation patient characteristics, 2012–2018

	HIV-Positive (n=1945)	HIV-Negative (n=345,879)	p-value
Male, No (%)	1405 (72.2)	210051 (60.7)	<0.001
Age, Mean ± SD	55.5 ± 10.4	65.6 ± 14.4	<0.001
Elective versus non-elective admission, No (%)	559 (28.9)	144865 (42.1)	<0.001
Race, No (%)			<0.001
1 White	547 (28.8)	223221 (67.4)	
2 Black	1101 (58.0)	60700 (18.3)	
3 Hispanic	162 (8.5)	31138 (9.4)	
4 Asian or Pacific Islander	7 (0.4)	5186 (1.6)	
5 Native American	3 (0.2)	2356 (0.7)	
6 Other	77 (4.1)	8650 (2.6)	
HCV, No (%)	374 (19.2)	6372 (1.8)	< 0.001
Claudication, No (%)	449 (23.1)	97984 (28.3)	< 0.001
CLI, No (%)	436 (22.4)	100535 (29.1)	< 0.001
Prior amputation, No (%)	163 (8.4)	28029 (8.1)	0.655
Tobacco, No (%)	914 (47.0)	151304 (43.7)	0.003
Median household income national quartile for patient ZIP Code, No (%)			< 0.001
1	895 (52.0)	115684 (34.1)	
2	399 (23.2)	91578 (27.0)	
3	268 (15.6)	76019 (22.4)	
4	160 (9.3)	56305 (16.6)	
Congestive Heart Failure, No (%)	157 (8.1)	33227 (9.6)	0.021
Valvular Disease, No (%)	38 (2.0)	8944 (2.6)	0.079
Pulmonary circulation disorders, No (%)	32 (1.6)	4451 (1.3)	0.162
Peripheral vascular disorders, No (%)	829 (42.6)	181007 (52.3)	<0.001
Paralysis, No (%)	758 (3.9)	11580 (3.3)	0.214
Neurological disorders, No (%)	144 (7.4)	22454 (6.5)	0.103
Chronic Pulmonary Disease, No (%)	446 (22.9)	185671 (24.8)	0.060
Diabetes Mellitus, No (%)			
- Without complications	250 (12.9)	59112 (17.1)	<0.001
- with complications	433 (22.3)	101672 (29.4)	<0.001

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	HIV-Positive (n=1945)	HIV-Negative (n=345,879)	p-value
Hypothyroidism, No (%)	92 (4.7)	35517 (10.3)	<0.001
Renal Failure, No (%)	865 (44.5)	107858 (31.2)	<0.001
Liver disease, No (%)	234 (12.0)	9117 2.6)	< 0.001
Peptic Ulcer Disease, No (%)	11 (0.6)	1283 (0.4)	0.159
AIDS, No (%)	772 (39.7)	21 (0.0)	< 0.001
Lymphoma, No (%)	23 (1.2)	1631 (0.5)	<0.001
Metastatic cancer, No (%)	20 (1.0)	3708 (1.1)	0.851
Solid tumor without metastases, No (%)	29 (1.5)	5267 (1.5)	0.908
Rheumatoid arthritis/collagen vascular diseases, No (%)	21 (1.1)	10218 (3.0)	<0.001
Coagulopathy, No (%)	216 (11.1)	23722 (6.9)	<0.001
Obesity, No (%)	150 (7.7)	45070 (13.0)	<0.001
Weight loss, No (%)	204 (10.5)	27571 (8.0)	<0.001
Fluid and electrolyte disorders, No (%)	618 (31.8)	96096 (27.8)	<0.001
Chronic blood loss anemia, No (%)	24 (1.2)	4872 (1.4)	0.514
Deficiency anemias, No (%)	710 (36.5)	93927 (27.2)	<0.001
Alcohol abuse, No (%)	74 (3.8)	12123 (3.5)	0.473
Drug abuse, No (%)	196 (10.1)	7716 (2.2)	< 0.001
Psychoses, No (%)	124 (6.4)	9359 (2.7)	<0.001
Depression, No (%)	258 (13.3)	34316 (9.9)	<0.001
Ischemic heart disease, No (%)	572 (29.4)	144057 (41.6)	< 0.001
Ischemic stroke, No (%)	11 (0.6)	3211 (0.9)	0.095
TIA, No (%)	4 (0.2)	706 (0.2)	0.988

PVI=peripheral vascular intervention, No=number, HIV=human immunodeficiency virus, SD=standard deviation, HCV=hepatitis C virus, CLI=critical limb ischemia, AIDS=acquired immunodeficiency syndrome, TIA=transient ischemic attack

Table 2.

Hospital characteristics for PVI and primary amputation admissions

Hospital characteristic	HIV-Positive (n=1945)	HIV-Negative (n=345,879)	p-value
Urban/Rural, No (%)			<0.001
1 Central counties of metro areas of >=1 mill pop	739 (49.8)	80101 (27.6)	
2 Fringe counties of metro areas of >=1 mill pop	292 (19.7)	66101 (22.8)	
3 Counties in metro areas of 250,000–<1mill pop	245 (16.5)	60733 (20.9)	
4 Counties in metro areas of 50,000–<250,000 pop	87 (5.9)	28742 (9.9)	
5 Micropolitan counties	70 (4.7)	30608 (10.6)	
6 Not metropolitan or micropolitan counties	50 (3.4)	23730 (8.2)	
Bed size, No (%)			<0.001
1 Small	190 (9.8)	43143 (12.5)	
2 Medium	508 (26.1)	94328 (27.3)	
3 Large	1247 (64.1)	208408 (60.3)	
Ownership, No (%)			<0.001
1 Government	284 (14.6)	36244 (10.5)	
2 Private non-profit	1416 (72.8)	259582 (75.0)	
3 Private investor-owned	245 (12.6)	50053 (14.5)	
Teaching status, No (%)			<0.001
1 Rural	44 (2.3)	17834 (5.2)	
2 Urban nonteaching	350 (18.0)	86980 (25.1)	
3 Urban teaching	1551 (79.7)	241065 (69.7)	
Region, No (%)			<0.001
1 Northeast	496 (25.5)	62693 (18.1)	
2 Midwest	259 (13.3)	78611 (22.7)	
3 South	1020 (52.4)	147752 (42.7)	
4 West	170 (8.7)	56823 (16.4)	

PVI=peripheral vascular intervention, HIV=human immunodeficiency virus, No=number, mill=million, pop=population, metro=metropolitan