Outcomes of Percutaneous Coronary Intervention in Patients With Acquired Immunosuppression

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There are limited data on the clinical outcomes of percutaneous coronary intervention (PCI) in patients with acquired immunosuppression who are frequently underrepresented in clinical trials. All PCI procedures between October 2015 and December 2018 in the Nationwide Inpatient Sample were retrospectively analyzed, stratified by immunosuppression status. Multivariable logistic regression models were performed to examine (1) the association between immunosuppression status and in-hospital outcomes, expressed as adjusted odds ratio (aOR) with 95% confidence intervals (CIs) and (2) predictors of mortality among patients with severe acquired immunosuppression. In this contemporary analysis of nearly 1.5 million PCI procedures, approximately 4% of patients who underwent PCI had acquired immunosuppression. Of these, chronic steroid use accounted for approximately half of the cohort who underwent PCI who had acquired immunosuppression, with the remainder divided between hematologic cancer, solid organ active malignancy, and metastatic cancer, with the latter group having the highest rates of composite of in-hospital mortality or stroke (9.3%) (mortality 7.5% and acute ischemic stroke 2.4%). In conclusion, immunosuppression was independently associated with increased adjusted odds of adverse clinical outcomes, specifically mortality or stroke (aOR 1.11, 95% CI 1.06 to 1.15, p <0.001) and in-hospital mortality (aOR 1.21, 95% CI 1.13 to 1.29, p <0.001), with outcomes dependent on the cause of immunosuppression. **(Am J Cardiol 2022;00:1−9)**

Introduction

Adults living with immunosuppressive illness represent approximately 6% of the global population.[1] With improvements in early diagnosis and treatment of immunosuppressed conditions such as cancer and post-transplantation,[2,3] patients with immunosuppression are now living longer. However, these patients often die of cardiovascular causes such as coronary artery disease (CAD) rather than their underlying immunosuppressed state.[4] CAD is now one of the leading causes of death among cancer and transplant survivors.[5−7] CAD manifesting after cancer and transplant can be attributed to many factors; inflammatory state associated with malignancies shared cardiovascular risk factor profile of CAD and cancer and exposure to cardiotoxic chemotherapies and immunosuppressive drugs.[7] Percutaneous coronary intervention (PCI) is the most common form of revascularization in patients with CAD, including those with complex disease and co-morbidities.[8] Although previous studies have examined the outcomes of PCI among patients with cancer[8] and lymphoma,[9] there are no previous studies reporting the clinical outcomes of PCI among patients who are immunocompromised. The present study sought to compare clinical outcomes of PCI between patients with and without acquired immunosuppression in a nationally representative cohort of hospitalizations in the United States between 2015 and 2018.

Methods

The National Inpatient Sample (NIS) is the largest all-payer inpatient health care database in the United States, developed by the Healthcare Cost and Utilization Project and sponsored by the Agency for Healthcare Research and Quality.[10] The NIS data set contains hospital information of approximately 8 million yearly hospital discharges, accounting for approximately 20% of all discharges from US community hospitals.

We analyzed all adult (≥18 years) inpatients who underwent PCI from October 1, 2015, through December 2018. Patient and procedural characteristics were extracted using the International Classification of Diseases, 10th Revision (ICD-10). Information on patient demographics was recorded for each hospital discharge, including age, gender, race, admission day (weekday or weekend), expected primary payer, and median household income according to ZIP code. Patients with missing records for age, gender,

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See page 7 for disclosure information.

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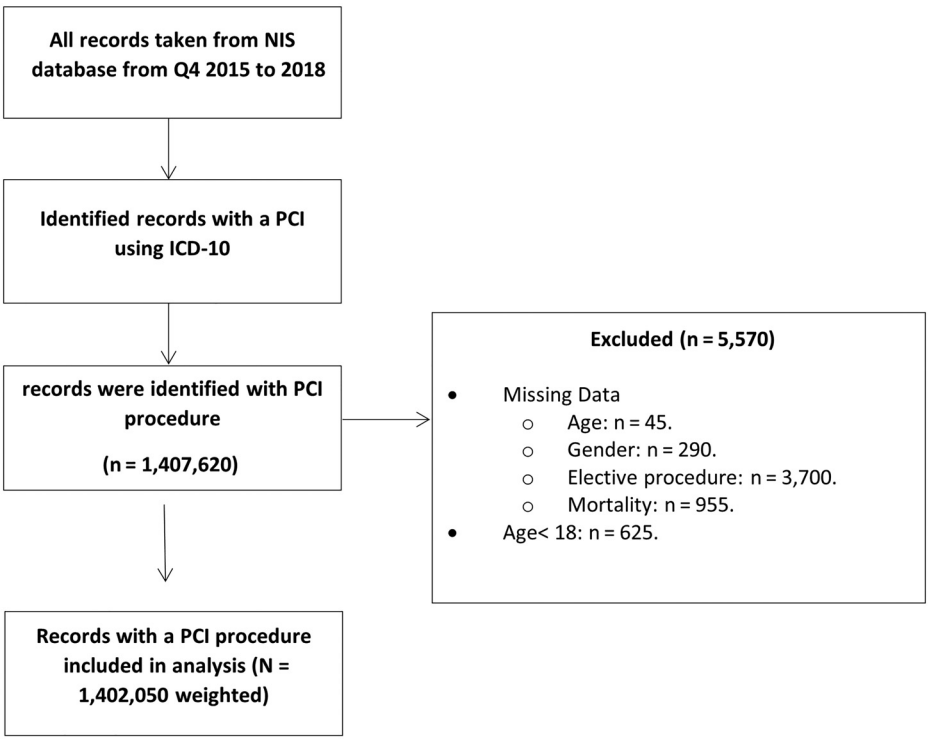

Figure 1. Flow diagram of study population.

elective admissions, and mortality status were excluded from the analysis (Figure 1 for study flow diagram). Each discharge record had information on up to 30 diagnoses. Patients with acquired immunosuppression were defined as receiving long-term steroid use, having conditions such hematologic or metastatic malignancy, having undergone solid organ transplant or bone marrow transplant, or having other conditions resulting in immunodeficiency.[11] Similar classifications have also been used in previous studies[12] with patients with acquired immunosuppression having concurrent (albeit noncardiac) conditions. A full list of ICD-10, Clinical Modification, codes used to identify patients with acquired immunosuppression and other patient characteristics and complications is provided in Supplementary Table 1. ICD-10, Clinical Modification, codes were also used to identify procedural information during hospitalization use of mechanical ventilation, circulatory support, and palliative care consultation.

The primary outcome measured was in-hospital all-cause mortality among patients with and without acquired immunosuppression. Other outcomes included a composite of in-hospital mortality or acute ischemic stroke and major bleeding and acute ischemic stroke. Major bleeding events were defined as a significant decrease in hemoglobin in the context of gastrointestinal, retroperitoneal, intracranial, intracerebral, periprocedural, or unspecified hemorrhage, or needing a blood transfusion.

Continuous variables are presented as a median and interquartile range because of skewed data, and categoric data are presented as frequencies and percentages. Categoric variables were compared using Pearson chi-square test, whereas continuous variables were compared using the Student *t* test or the Mann-Whitney *U* test, as appropriate. Sampling weights were used to calculate the estimated total discharges as specified by Agency for Healthcare Research and Quality. Multivariable logistic regression models were used to examine the association between immunosuppressed status and in-hospital outcomes, and to reveal predictors of mortality among patients with severe acquired immunosuppression, all expressed as odds ratios (ORs) with corresponding 95% confidence intervals (CIs).

The models were adjusted for baseline differences between the groups, controlling for the following covariates: age, gender, elective and weekend admissions, race, hospital region, hospital location/teaching status, hospital bed size, primary payer, median zip income, ST-elevation myocardial infarction (STEMI), cardiogenic shock, *ventricular fibrillation* (VF), ventricular tachycardia, *atrial fibrillation*, heart failure, mechanical ventilation, use of assist device/intra-aortic balloon pump, previous myocardial infraction (MI), previous stroke, diabetes, hypertension, dyslipidemia, peripheral vascular disease, renal failure, valvular disease, thrombocytopenia, coagulopathy, anemia, chronic liver and lung diseases, smoking status, dementia, and malignancy. Sensitivity analysis was performed to reveal differences in baseline characteristics and in-hospital outcomes between different etiologies of immunosuppressed status (chronic steroid use, hematologic malignancies, metastatic malignancy, postsolid organ transplant status, and other causes). Analysis was performed using the chi-square or Kruskal-Wallis test, as appropriate. All statistical analyses were performed on IBM SPSS version 26. Statistical significance was set at the 2-tailed .05 level, without multiplicity adjustment.

Table 1
Demographics, record characteristics, and co-morbidities of patients

Variable	Non- Immunocompromised (n = 1,353,100)	Immunocompromised (n = 48,950)	p value
Age (years), median (IQR)	65 (56,74)	69 (60,76)	<0.001
Male	67.1%	62.4%	<0.001
			<0.001
White	76.1%	79.7%	
Black	10%	10.4%	
Hispanic	7.4%	5.4%	
Asian/Pacific Islander	2.4%	1.9%	
Native American	0.5%	0.4%	
Other	3.5%	2.3%	
Hospital region			<0.001
Northeast	19%	18%	
Midwest	25.8%	30.5%	
South	41.6%	38.6%	
West	13.7%	12.9%	
Hospital size			<0.001
Small	13.8%	12.6%	
Medium	29.2%	27.5%	
Large	56.9%	60%	
Hospital location/teaching status			<0.001
Rural	5.8%	5%	
Urban nonteaching	23.1%	20.3%	
Teaching	71.1%	74.7%	
Elective admission	9.9%	9.8%	0.97
Weekend admission	23.7%	23.5%	0.27
Median ZIP income, quartile			<0.001
1st	29.9%	29.3%	
2nd	27.7%	26.1%	
3rd	23.9%	24.7%	
4th	18.5%	19.9%	
Expected primary payer			<0.001
Medicare	53.1%	68.8%	
Medicaid	9.4%	6.6%	
Private	29.4%	20.8%	
Uninsured	4.7%	1.7%	
No charge	0.5%	0.1%	
Other	2.9%	2%	
Record characteristics			
STEMI	30.9%	23.6%	<0.001
NSTEMI	40.9%	45.1%	<0.001
Cardiac arrest	2.9%	2.8%	0.21
Ventricular fibrillation	3.8%	2.9%	<0.001
Ventricular tachycardia	7.5%	7.3%	0.13
Cardiogenic shock	5.6%	5.6%	0.66
Length of stay, days, median (IQR)	3 (2,4)	3 (2,6)	<0.001
Total charge, $, median (IQR)	82,410 (57,743, 125,133)	89,046 (61,092, 135,189)	<0.001
Co-morbidities			
Previous MI	17.5%	20.9%	<0.001
Cerebrovascular disease	4%	4.3%	<0.001
Heart failure	27.2%	35.6%	<0.001
Valvular disease	11.2%	14.7%	<0.001
Atrial fibrillation/flutter	15.8%	21%	<0.001
Hypertension	81.3%	84.8%	<0.001
Dyslipidemia	71.8%	70.2%	<0.001
Diabetes mellitus	40.5%	43.1%	<0.001
Smoker	51.5%	54.9%	<0.001
Peripheral vascular disorder	8.5%	11.1%	<0.001
Renal failure	18.9%	29.6%	<0.001
Chronic lung disease	18.9%	40.5%	<0.001
Obesity	20.2%	18.4%	<0.001
Anemia	15.8%	28.6%	<0.001

(*continued*)

Table 1 (*Continued*)

Variable	Non- Immunocompromised (n = 1,353,100)	Immunocompromised (n = 48,950)	p value
Thrombocytopenia	3.2%	6.1%	<0.001
Coagulopathy	1.1%	2.2%	<0.001
Dementia	2.4%	2.1%	<0.001
Chronic liver disease	0.5%	1%	<0.001
Homelessness	0.2%	0.1%	0.002
Solid malignancy*	1.2%	11.9%	<0.001
Hematologic malignancies	<0.1%	19.4%	<0.001
Metastatic cancer	<0.1%	14.3%	<0.001

IQR = interquartile range; NSTEMI = non−ST-segment elevation myocardial infarction; STEMI = ST-segment elevation myocardial infarction.
* Solid active malignancy.

Results

A total of 1,407,620 PCI procedures were recorded between October 2015 and December 2018. Applying relevant exclusion criteria (Figure 1), we produced a study cohort consisting of 1,402,050 patients, of whom, 48,950 (3.5%) were in the group with acquired immunosuppression. The most common cause for immunosuppression was chronic systemic steroid use (50.7%), followed by hematologic malignancy (18.8%), metastatic disease (14.2%), and solid organ transplant (13.3%).

Differences in clinical characteristics were observed between the groups with and without acquired immunosuppression are presented in Table 1. Patients with acquired immunosuppression were older (median age 69 vs 65 years), less likely to be male (62.4% vs 67.1%) and to be admitted with STEMI (23.6% vs 30.9%) They also had a higher prevalence of significant co-morbidities, including previous MI (20.9% vs 17.5%), heart failure (35.6% vs 27.2%), valvular heart disease (14.7% vs 11.2%, p <0.001), atrial fibrillation/flutter (21% vs 15.8%), hypertension (84.8% vs 81.3%), chronic renal failure (29.6% vs 18.9%), chronic lung disease (40.5% vs 18.9%), and anemia (28.6% vs 15.7%). However, patients with acquired immunosuppression had slightly lower prevalence of dyslipidemia (70.2% vs 71.8%) and obesity (18.4% vs 20.2%) (p <0.001 for all).

When stratified by cause of immunosuppression, several differences in baseline characteristics and in-hospital outcomes were noted (Supplementary Tables 2 and 3, respectively). Patients with hematologic or metastatic malignancies were older (median age 71 to 72 vs 64 to 68, p <0.001) and were more likely to be White (83.5% to 84.2% vs 69.5% to 79.2%, p <0.001). Patients with metastatic malignancies were mostly likely to be admitted with STEMI (34.3% vs 21.6% to 22.6%, p <0.001), to experience cardiac arrest (4.4% vs 2.2% to 3.3%) or ventricular tachycardia (10.6% vs 5.5% to 8.3%, p <0.001), VF (4.7% vs 2.1% to 3.9%. p <0.001), or cardiogenic shock (8.6% vs 4.3% to 6.6%, p <0.001). Patients receiving long-term systemic steroid treatment were the least likely to experience cardiac arrest (2.2%), VF (2.1%), or cardiogenic shock (4.3%). Known previous vascular diseases were most commonly observed in the long-term steroid treatment group. This included previous MI (23.5% vs 17.7% to 18.4%, p <0.001), cerebrovascular disease (4.7% vs 3.5% to 4.1%, p <0.001), and peripheral vascular disease (12.4% vs 8.9% to 11.4%, p <0.001), as well as chronic lung disease (59.1% vs 14.1% to 25.6%, p <0.001). Recipients of solid organ transplant had the highest rates of diabetes mellitus (61.8% vs 38.2% to 40.8%, p <0.001), hypertension (90.6% vs 79.7% to 86.1%, p <0.001), and renal failure (60.5% vs 23.1% to 28.7%, p <0.001).

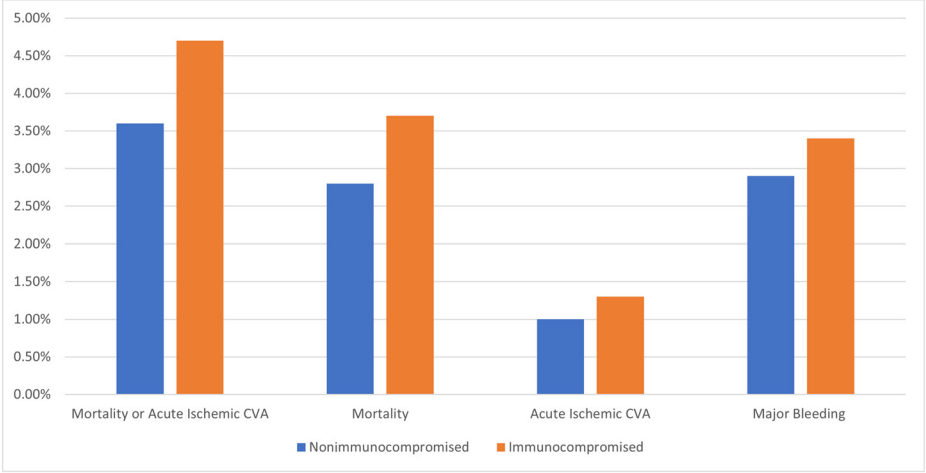

Figure 2. Destination of discharge. CVA = cerebrovascular accident.

Table 2
Crude rates In-hospital procedures and adverse events

Variable	Nonimmunocompromised (n = 1,353,100)	Immunocompromised n = 48,950 (3.5%)	p value
Mortality or acute ischemic CVA*	3.6%	4.7%	<0.001
Mortality	2.8%	3.7%	<0.001
Acute ischemic CVA	1%	1.3%	<0.001
Vascular complications	0.3%	0.4%	0.76
Postprocedural shock	0.3%	0.3%	0.14
Major bleeding	2.9%	3.4%	<0.001
GI bleed	1.4%	1.9%	<0.001
Procedural related bleeding	1.2%	1.3%	0.19
Retroperitoneal bleed	0.2%	0.2%	0.17
Intracranial hemorrhage	0.1%	0.2%	0.66
Mechanical ventilation	5.5%	6.2%	<0.001
Circulatory support (including IABP, LV assist device, and ECMO)	5.5%	5.8%	0.005
Palliative consultation	1.2%	2.4%	<0.001

CVA = cerebrovascular accident; ECMO = extracorporeal membrane oxygenation; GI = gastrointestinal; IABP = intra-aortic balloon pump; LV = left ventricular.

* Composite of mortality and acute ischemic stroke.

The destination of discharge for patients is shown in Figure 2. Patients with acquired immunosuppression were more likely to be discharged to a nursing or intermediate care facility (8.9% vs 6.7%) or die in-hospital (3.8% vs 2.8%).

Differences in the crude rates of in-hospital procedures and outcomes between the 2 groups are presented Figure 3, Table 2. Patients with acquired immunosuppression were more likely to undergo mechanical ventilation (6.2% vs 5.5%, p <0.001) and circulatory support (5.7% vs 5.5%, p = 0.02) and to receive palliative consultation (2.4% vs 1.2%, p <0.001). Patients with acquired immunosuppression were shown to have higher in-hospital mortality (3.7% vs 2.8%), acute ischemic stroke (1.3% vs 1.0%), major bleeding (3.4% vs 2.9%) and mortality/stroke composite (4.7% vs 3.6%) (p <0.001 for all). When adjusted for important baseline characteristics and co-morbidities (Table 3), patients with acquired immunosuppression had increased rates of mortality/stroke composite (aOR 1.1, 95% CI 1.06 to 1.15, p <0.001) and in-hospital mortality (aOR 1.21, 95% CI 1.13 to 1.29, p <0.001), with no increase in acute ischemic stroke or major bleeding.

Predictors of in-hospital mortality for patients with acquired immunosuppression are presented in Table 4.

Patients with metastatic malignancy had the highest rates of composite of in-hospital mortality/stroke (9.3%), mortality (7.5%), and acute ischemic stroke (2.4%), followed by patients with hematologic malignancies (6.5%, 5%, and 1.8%, respectively). Recipients of solid organ transplant had rates of composite of in-hospital mortality/stroke (4.4%), mortality (3.4%), and major bleeding (2.9%), whereas the lowest crude rates of composite of in-hospital mortality/stroke (3.1%), mortality (2.3%), and acute ischemic stroke (0.8%) were observed in the chronic systemic steroid treatment subgroup (Supplementary Table 3).

Discussion

In this analysis of nearly 1.5 million PCI procedures, approximately 4% of patients who underwent PCI had a diagnosis of acquired immunosuppression. We report that a current diagnosis of immunosuppression was independently associated with significantly increased adjusted odds of

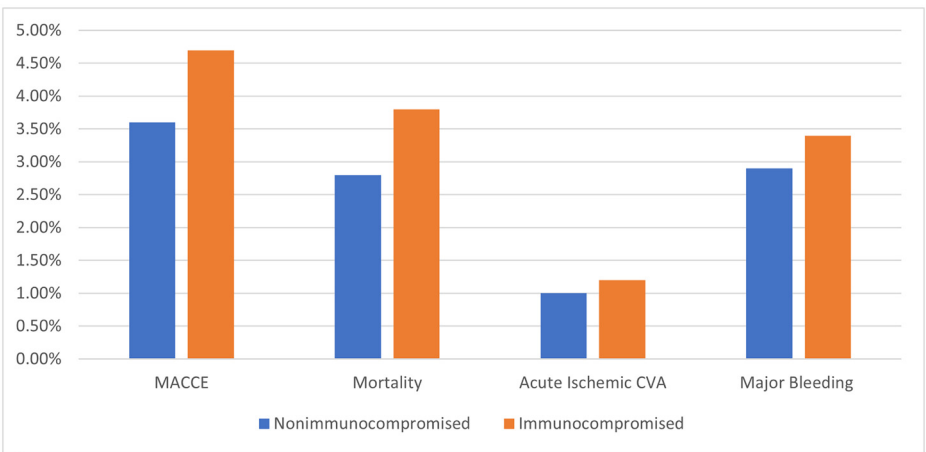

Figure 3. Crude rate of major in-hospital outcomes. CVA = cerebrovascular accident; MACCE = major adverse cardiac and cerebrovascular event.

Table 3
Adjusted odds ratios (ORs) and 95% confidence intervals (CI) of in-hospital adverse outcomes* in immunocompromised patients

Variable	OR (95% CI)	p value
Mortality or acute ischemic CVA	1.11 (1.06-1.15)	<0.001
Mortality	1.21 (1.13-1.29)	<0.001
Acute ischemic CVA	1.05 (0.95-1.16)	0.32
Major bleeding	0.97 (0.93-1.02)	0.23

CVA = cerebrovascular accident.

*Reference group − nonimmunocompromised. Adjusted for age, gender, elective and weekend admissions, race, hospital region, hospital location/teaching status, hospital bed size, primary payer, median zip income, ST-segment elevation myocardial infarction, cardiogenic shock, ventricular fibrillation, ventricular tachycardia, atrial fibrillation, heart failure, mechanical ventilation, use of assist device/intra-aortic balloon pump, previous myocardial infarction, cerebrovascular disease, diabetes, hypertension, dyslipidemia, peripheral vascular disease, renal failure, valvular disease, thrombocytopenia, coagulopathy, anemia, chronic liver and lung diseases, smoking status, dementia, malignancy.

adverse clinical outcomes, specifically in-hospital mortality or acute ischemic stroke. No comparable study, to our knowledge, has reported on the clinical outcomes of patients with acquired immunosuppression who underwent PCI. Limited data in this field are likely explained by the fact that patients with acquired immunosuppression are frequently excluded from randomized controlled trials, and a history of immunosuppression is not captured in national PCI registries.

The worse adjusted outcomes reported for mortality among the group with acquired immunosuppression are likely to be multifactorial and to some extent dependent on the etiology of immune suppression. We note a significantly higher proportion of patients with acquired immunosuppression having cancer in the form of solid active malignancy (11.4% vs 1.2%), hematologic malignancy (18.5% vs <0.1%), and metastatic cancer (13.6% vs <0.1%). Cancer correlates with a hypercoagulable state as malignant cells have a propensity to trigger the coagulation cascade and lead to inflammatory cytokine and acute phase reactant formation, thus putting patients with cancer at high risk for thrombosis.[8,13]

One notable factor in our analysis is chronic systemic steroid use, which represents the largest subgroup (nearly 50%) of our cohort with acquired immunosuppression. Steroids are known to have a propensity to cause hyperglycemia, hypertension, dyslipidemia, and central obesity, which are all established risk factors for cardiovascular disease.[14,15] The cumulative evidence acquired over the past few decades, demonstrating increased atherosclerosis among patients with Cushing syndrome, suggests that steroids may drive pathologic plaque development, with patients with Cushing syndrome exhibiting higher circulating low-density lipoprotein levels, thickened intimal-medial layer, and luminal narrowing in the carotid vasculature compared with non-Cushing population.[16] Apart from its cardiovascular implications, long-term steroid use in patients with PCI is also considered a minor ARC-HBR criterion, as per the Academic Research Consortium for high bleeding risk.[17]

In line with previous studies[18,19] showing increased mortality with major bleeding and thrombotic events, our analysis shows anemia, thrombocytopenia, and coagulopathy to be significant predictors of mortality in the group with severe acquired immunosuppression who underwent PCI. This has important implications when balancing thrombotic versus hemorrhagic risks among patients with acquired immunosuppression, where due consideration has to be given to the optimal duration of dual antiplatelets after stent implantation. This may, in part, account for the increased use of balloon angioplasty alone or bare-metal stents (BMSs) that have been observed in some studies.[20,21] It has been previously demonstrated that the use of drug-eluting stents confers a sustained advantage in decreasing target vessel revascularization and, to a lesser extent, major adverse cardiac and cerebrovascular events compared with BMS at 6 years.[22] Notably, earlier comparative analyses have shown that in patients with anemia, the use of BMS was associated with increased mortality compared with the use of drug-eluting stents.[23]

Currently, risk stratification scores[24−26] consider multiple conditions to prognosticate patients who underwent PCI; however, none of the contemporary scores take immunosuppression into consideration despite the significant impact of the latter on outcomes after PCI. In patients whose immunosuppression is a potentially reversible status (for instance, patients on short-term immunosuppressant medications), operators should give due consideration to whether PCI is required urgently or whether intervention could be delayed until immunosuppression therapy has ceased.

Our analysis has limitations. As with any administrative database, coding errors represent a potential source of bias and underreporting of secondary diagnoses. The data set does not offer information pertaining to how long patients who underwent PCI have been immunosuppressed and does not give detailed information regarding which specific immunosuppressive therapy that a certain subgroup may be undergoing, which can itself be cardiotoxic. The NIS does not capture causes of mortality; therefore, it is unclear whether the excess mortality risk reported is due to an increased risk of cardiovascular mortality or whether some of the effect measured could, in part, be due to deaths secondary to the underlying condition causing the severe immunosuppression (e.g., cancer).

In addition, detailed procedural details are not recorded in the NIS, therefore limiting insights into differences in complexity of coronary disease, PCI procedural techniques, and clinical outcomes. In addition, no pharmacologic information is recorded on NIS, giving us limited insight as to whether patients with acquired immunosuppression were commenced on standard guideline-based antiplatelet therapy and secondary prevention after PCI. Finally, it is likely that individual immunosuppressive agents are associated with different cardiovascular risk profiles. In the future, a detailed analysis of clinical outcomes according to individual immunosuppressant agents would be desirable to investigate which particular regimes represent adverse prognostic indicators, which would have implications for

Table 4
Predictors of mortality among severely immunocompromised patients

Variable	OR (95% CI)	p value
Female	1.3 (1.15-1.47)	<0.001
Age*	1.04 (1.03-1.04)	<0.001
Race (White − reference)		
Black	0.88 (0.7-1.09)	0.24
Hispanic	1.08 (0.84-1.4)	0.56
Asian/Pacific Islander	1.3 (0.86-1.96)	0.21
Native American	1.59 (0.69-3.69)	0.28
Other	0.75 (0.49-1.14)	0.18
Hospital location (Northeast − reference)		
Midwest	0.99 (0.82-1.19)	0.89
South	1.08 (0.91-1.29)	0.37
West	1.14 (0.93-1.41)	0.19
Hospital location/ teaching status (Rural − reference)		
Urban nonteaching	1.21 (0.88-1.68)	0.23
Teaching	1.27 (0.94-1.72)	0.12
Weekend admission	0.98 (0.85-1.12)	0.76
Nonelective admission	0.94 (0.77-1.14)	0.55
Median ZIP income (1st quartile − reference)		
2nd	0.78 (0.66-0.91)	0.002
3rd	0.8 (0.68-0.94)	0.007
4th	0.66 (0.55-0.8)	<0.001
Expected primary payer (Medicare- reference)		
Medicaid	0.78 (0.57-1.07)	0.12
Private	0.88 (0.73-1.05)	0.16
Uninsured	0.75 (0.41-1.36)	0.34
No charge	1.91 (0.61-5.97)	0.26
Other	0.66 (0.4-1.07)	0.09
Previous MI	0.84 (0.71-0.99)	0.04
Cerebrovascular disease	0.67 (0.5-0.9)	0.01
Heart failure	1.55 (1.4-1.7)	<0.001
Valvular disease	0.92 (0.78-1.09)	<0.34
Atrial fibrillation/flutter	1.21 (1.1-1.3)	<0.001
Hypertension	0.71 (0.61-0.83)	<0.001
Dyslipidemia	0.66 (0.58-0.74)	<0.001
Diabetes mellitus	1.19 (1.05-1.34)	0.008
Smoker	0.97 (0.85-1.1)	0.61
Peripheral vascular disease	1.69 (1.42-2)	<0.001
Chronic lung disease	0.72 (0.62-0.82)	<0.001
Chronic renal failure	1.43 (1.25-1.63)	<0.001
Obesity	0.94 (0.78-1.12)	0.47
Anemia	1.3 (1.18-1.31)	<0.001
Thrombocytopenia	1.23 (1.02-1.49)	0.03
Coagulopathy	3.89 (3.09-4.9)	<0.001
Dementia	1.14 (0.82-1.58)	0.45
Chronic liver disease	0.78 (0.42-1.44)	0.43
Solid malignancy†	1.22 (0.99-1.51)	0.06
Hematologic malignancies	1.06 (0.91-1.23)	0.5
Metastatic cancer	1.81 (1.48-2.2)	<0.001

CI = confidence interval; MI = myocardial infarction; OR = odds ratio.
* Per 1-year increase.
† Solid active malignancy.

patients with acquired immunosuppression who underwent PCI.

In conclusion, in this contemporary analysis of nearly 1.5 million PCI procedures, approximately 4% of patients who underwent PCI were immunocompromised. Chronic systemic steroid use accounts for more than half of the cohort patients who underwent PCI that is immunosuppressed. We report that a current diagnosis of immunosuppression was independently associated with significantly increased adjusted odds of adverse clinical outcomes, specifically in-hospital mortality and ischemic stroke, with outcomes dependent on the cause of immunosuppression.

Disclosures

The authors have no conflicts of interest to declare.

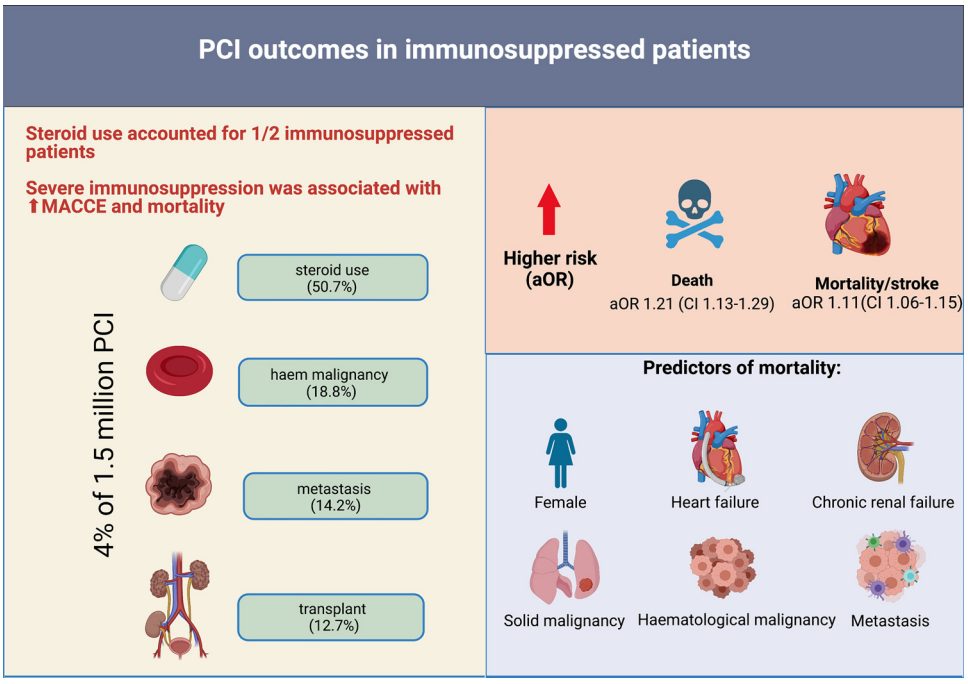

Figure 4. PCI outcomes in patients with acquired immunosuppression.

Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.amjcard.2022.01.045.

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