



Perioperative beta blockers and statins for noncardiac surgery patients with coronary stents



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ABSTRACT

Importance: Recent publications report that perioperative initiation of statin therapy is associated with improved outcomes particularly among patients with increased cardiac risk. However, findings on associations with beta blocker (BB) initiation are mixed.

Objective: This study examines associations between perioperative statin and BB use in a national sample of patients with cardiac stents.

Design: Retrospective cohort study.

Setting: VA Medical Centers nationwide.

Participants: We identified Veterans Affairs (VA) patients undergoing non-cardiac surgery in the within two years after stent placement between October 2002 and September 2011 with BB and/or statin prescriptions within one year prior to surgery. Using VA inpatient data we identified major adverse cardiac or cerebrovascular events (MACCE) within 30 days of surgery. General usage patterns and percent of days covered by medication were calculated as additional markers of medication use. Adjusted logistic regression was used to examine associations between medication use and 30-day postoperative outcomes.

Results: 23,537 patients underwent surgery within 2 years following stent placement, of whom 20,566 (88.6%) had prescriptions for beta blockers and statins within 365 days prior to surgery. Of those, 13,501 (65.6%) used both BB and statins prior to surgery, while 2626 (12.8%) used only BB, 2346 (11.4%) used only statins, and 2093 (10.2%) used neither. In fully adjusted models, the only significant association was between perioperative statin use and decreased mortality (OR 0.65, 95% CI 0.48–0.87).

Conclusions: Our results suggest that maintaining statin therapy perioperatively is associated with reduced 30 day mortality in stented patients undergoing non-cardiac surgery who have previously been prescribed both beta blockers and statins.

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1. Introduction

In recent years, much study has been devoted to the perioperative use of beta blockers (BB) and statins to reduce mortality and cardiac events. Results of BB studies have been mixed, with initial small trials showing improved outcomes with BB use but others such as the POISE trial and a large retrospective study by

Lindenauer et al. suggesting that the cardio-protective effects of BB use may come with an increased stroke risk, and possibly increased overall mortality.^{1–3} Perioperative statin use has generally been associated with improved outcomes, particularly decreased mortality.^{3–6} Studies of both drug classes suggest that the benefits of perioperative use increase with increased underlying cardiac risk.^{2,3,7} Many studies, particularly RCTs have been devoted to effects of initiating BB or Statin therapy perioperatively, while most observational studies have not distinguished between initiation and continuation.^{3–6,8,9} However, patients with a history of

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coronary artery disease (CAD), particularly those requiring coronary intervention, are often prescribed chronic BB and statin therapy to be continued indefinitely. For this group of patients for whom BB and statin therapy have already been initiated, the important, but less-studied, question is the relationship between postoperative outcomes and continued perioperative therapy.

The purpose of this study was to examine the associations of perioperative BB and statin use with postoperative major adverse cardiac and cerebrovascular events (MACCE) and mortality in a national cohort of Veterans Affairs patients with a history of coronary stenting undergoing non-cardiac surgery. We hypothesized that in this patient population with elevated cardiac risk, perioperative use of BB and statins would be associated with decreased MACCE.

2. Methods

All patients undergoing coronary stenting in the VA between October 1, 2002 and September 30, 2011 were identified either from the VA Clinical Assessment, Reporting, and Tracking (CART) program data or by the occurrence of ICD9 procedure codes of 36.06 for bare metal stents (BMS) and 36.07 for drug-eluting stents (DES) in VA Medical SAS datasets. Non-cardiac surgeries in the 2 years following stent placement were identified by the National Surgery Office. Using VA pharmacy data we limited the cohort to patients who had at least one prescription for both a BB and a statin within 365 days prior to surgery. This included any outpatient prescription or an inpatient prescription with at least a 30-day supply.

The main outcome variable was any major adverse cardiac or cerebrovascular event (MACCE) in the 30-days following surgery; a composite outcome of death, acute MI, a revascularization procedure, or a stroke as identified from the VA Medical SAS Datasets or non-VA healthcare utilization from the VA Information Resource Center's Center for Medicaid and Medicare Services (CMS) data for veterans. Each component of MACCE was considered separately as a secondary outcome. As with postoperative outcomes, preoperative co-morbidities were determined using the VA Medical SAS Datasets in combination with non-VA healthcare utilization captured by CMS. The study population and definition of study variables have been previously described.¹⁰

The main independent variable reflected the perioperative use of BB and statin therapy and captured whether the patient had current BB or statin usage prior to surgery. For a patient admitted on the day of surgery this was defined as having a prescription with remaining supply at the time of surgery, or which expired within 7 days prior to surgery, after inflating the prescription duration by 20% to account for approximately 80% adherence.¹¹ For patients admitted on days prior to surgery, exposure was defined from inpatient pharmacy records by the receipt of drugs on the day before or of surgery. Patients' perioperative medications were classified separately as BB, yes or no; Statins, yes or no; and together as neither, BB alone, statin alone, or both. We developed a separate set of variables classifying the patients' general usage patterns for each class of drugs as chronic (no gaps in coverage >90 days during the year prior to surgery); recently initiated (first prescription or inpatient administration within 90 days prior to surgery), and discontinued (medication supply from last prescription exhausted more than 90 days prior to surgery). We also calculated patient's adherence to their BB and Statin therapies separately, as percent of days covered (PDC). PDC was calculated if the patient had at least two prescriptions in the year prior to surgery and was calculated as the percent of days covered between the first and last prescription. To control for potential confounding due to antiplatelet therapy, similar variables were constructed for

clopidogrel.

Univariate and bivariate frequencies were used to examine differences in population characteristics and outcomes by BB and statin use, with Chi-square tests and t-tests used to assess statistical significance. Logistic regression was used to calculate odds ratios of study outcomes with respect to medication use with adjustment for usage patterns and PDC. For statistical modeling, we used one indicator variable to indicate that a PDC was calculated, and then included the PDC itself as an interaction term set to be zero when the PDC was not defined. Initial models explicitly tested for interactions between BB and statin usage; finding no suggestion of interactions, final models included both BB and statin use without interaction terms.

The first set of models (MedUse-Adjusted) adjusted only for drug usage and possession variables. Fully-adjusted models included stent type (DES vs BMS), time from most recent stent to surgery, age, revised cardiac risk index, prior stents, clopidogrel usage and possession, procedure specialty, work relative value units, diabetes, chronic kidney disease, acute myocardial infarction in the six months prior to surgery, congestive heart failure in the six months prior to surgery, elective vs. non-elective procedure, and whether the surgery took place before or after the 2008 guidelines regarding appropriate time to surgery after BMS and DES implantation.¹² To explore the possible variation in associations by cardiac risk, models were repeated stratified by the revised cardiac risk index. To further examine associations for patients with elevated cardiac risk, all analyses were repeated using a cohort limited to patients with an acute MI within two years prior to surgery. R version 3.0.1 was used for all analyses.¹³

3. Results

23,537 VA patients underwent surgery within 2 years following stent placement, and 20,579 (87.4%) of these patients had prescriptions for both BB and statins within 365 days prior to surgery. Table 1 shows patient and operative characteristics overall and by medications on hand at the time of surgery. Of those, 7789 (37.8%) had an MI within two years prior to surgery. The majority of patients, 13,509 (65.6%) used both BB and statins prior to surgery, while 2628 (12.8%) used only BB, 2346 (11.4%) used only statins, and 2096 (10.2%) used neither. As seen in Table 1 many factors are significantly associated with preoperative medication use. Patients were most likely to have both medications on-hand and least likely to have neither on hand when their surgery occurred <6 weeks after stent placement compared to patients with surgery more than 3 months after stent placement (77.8% vs. 64.5%, and 5.8% vs. 10.8%, respectively). Fig. 1 shows the probability of beta blocker and statin use by time from stent placement to surgery with the highest probabilities for those with surgery within 6 months of stent placement or more than 18 months after stent placement. This bimodal distribution persisted in fully adjusted models, models limited to the first surgery after stent placement, and models limited to patients who survived at least two years after stent placement.

In unadjusted analyses, perioperative medication use was significantly associated with MACCE, with rates of 5.5% for BB and statin use, 6.0% for BB only, 5.4% for statins only, and 7.1% for neither ($p = 0.03$). Among the MACCE components only 30-day mortality was significantly associated with medication usage, with rates, respectively, of 1.1%, 1.9%, 1.0%, and 1.9%, respectively ($p < 0.001$). Table 2 shows the unadjusted associations of perioperative medication use and overall medication usage patterns with study outcomes.

Table 3 shows the associations between perioperative usage and outcomes using logistic regression both overall and stratified by

Table 1

Patient characteristics by perioperative beta blocker and statin use.

		Overall	None	BBs Only	Statins Only	BBs and Statins	p value
		N (%)	N (%)	N (%)	N (%)	N (%)	
		20579	2096 (10.2)	2628 (12.8)	2346 (11.4)	13,509 (65.6)	
Demographics/Comorbidities							
Age at Surgery	<60	5037 (24)	547 (11)	657 (13)	549 (11)	3284 (65)	0.17
	≥60	15542 (76)	1549 (10)	1971 (13)	1797 (12)	10225 (66)	
MI Past 2 Years	Yes	7789 (38)	894 (11)	1008 (13)	866 (11)	5021 (64)	<0.001
MI Past 6 Months	Yes	18766 (91)	1915 (10)	2393 (13)	2171 (12)	12287 (65)	0.09
CHF Past 6 Months	Yes	671 (3)	90 (13)	114 (17)	81 (12)	386 (58)	<0.001
Chronic Kidney Disease in Past Year	None	19657 (96)	1995 (10)	2489 (13)	2241 (11)	12932 (66)	0.13
	Stage 1–5	708 (3)	73 (10)	101 (14)	80 (11)	454 (64)	
	Dialysis (stage 6)	214 (1)	28 (13)	38 (18)	25 (12)	123 (57)	
Diabetes	None	10490 (51)	1042 (10)	1334 (13)	1188 (11)	6926 (66)	0.10
	Non-Insulin Dependent	6049 (29)	664 (11)	804 (13)	684 (11)	3897 (64)	
	Insulin Dependent	4040 (20)	390 (10)	490 (12)	474 (12)	2686 (66)	
Revised Cardiac Risk Index	1	7973 (39)	809 (10)	978 (12)	946 (12)	5240 (66)	
	2	6776 (33)	666 (10)	852 (13)	739 (11)	4519 (67)	0.04
	≥3	5830 (28)	621 (11)	798 (14)	661 (11)	3750 (64)	
Stent Characteristics							
Stent Type	Bare Metal Stent	8774 (43)	840 (10)	1208 (14)	982 (11)	5744 (65)	<0.001
	Drug-Eluting Stent	11805 (57)	1256 (11)	1420 (12)	1364 (12)	7765 (66)	
Prior Stent Episodes within 2 Years	0	17250 (84)	1765 (10)	2236 (13)	1943 (11)	11306 (66)	0.40
	1	2754 (13)	277 (10)	324 (12)	339 (12)	1814 (66)	
	>1	575 (3)	54 (9)	68 (12)	64 (11)	389 (68)	
Surgery Characteristics							
Admission Status	Outpatient	11619 (56)	1074 (9)	1416 (12)	1375 (12)	7754 (67)	
	Elective Inpatient	8665 (42)	937 (11)	1165 (13)	939 (11)	5624 (65)	0.004
	Non-Elective Inpatient or Transfer	295 (1)	85 (29)	47 (16)	32 (11)	131 (44)	
RVU	Mean (SD)	10.3 (7.7)	10.2 (7.6)	10.5 (7.7)	10.1 (7.5)	10.3 (7.7)	0.24
Procedure Type	Eye/Ear	3820 (19)	324 (8)	458 (12)	458 (12)	2580 (68)	
	Genital/Urinary	4033 (20)	400 (10)	520 (13)	451 (11)	2662 (66)	
	Integumentary	1977 (10)	213 (11)	252 (13)	213 (11)	1299 (66)	
	Musculoskeletal	2617 (13)	292 (11)	303 (12)	313 (12)	1709 (65)	
	Nervous	1108 (5)	115 (10)	155 (14)	123 (11)	715 (65)	0.004
	Other	293 (1)	34 (12)	39 (13)	36 (12)	184 (63)	
	Digestive	2559 (12)	253 (10)	329 (13)	265 (10)	1712 (67)	
	Vascular	3273 (16)	377 (12)	462 (14)	386 (12)	2048 (63)	
	Respiratory	899 (4)	88 (10)	110 (12)	101 (11)	600 (67)	
Time Between Stent and Surgery	<6 weeks	844 (4)	49 (6)	74 (9)	64 (8)	657 (78)	
	6 weeks–3 months	2029 (10)	138 (7)	231 (11)	222 (11)	1438 (71)	<0.001
	3–12 months	8315 (40)	869 (10)	1144 (14)	1037 (12)	5265 (63)	
	>12 months	9391 (46)	1040 (11)	1179 (13)	1023 (11)	6149 (65)	
Timing of Operation	Pre-Guidelines	11016 (54)	949 (9)	1472 (13)	1219 (11)	7376 (67)	<0.001
	Post-Guidelines	9563 (46)	1147 (12)	1156 (12)	1127 (12)	6133 (64)	
Medication Characteristics							
Any Clopidogrel		11189 (54)	653 (6)	1326 (12)	1260 (11)	7950 (71)	<0.001
Clopidogrel On Hand		9736 (47)	506 (5)	1126 (12)	1065 (11)	7039 (72)	<0.001
BB Usage	Chronic Use	18436 (90)	1582 (9)	2392 (13)	1796 (10)	12666 (69)	
	Recent Initiation	1863 (9)	391 (21)	228 (12)	412 (22)	832 (45)	<0.001
	Discontinued	280 (1)	123 (44)	8 (3)	138 (49)	11 (4)	
Statin Usage	Chronic Use	18311 (89)	1550 (8)	1981 (11)	2168 (12)	12612 (69)	
	Recent Initiation	1998 (10)	422 (21)	506 (25)	175 (9)	895 (45)	<0.001
	Discontinued	270 (1)	124 (46)	141 (52)	3 (1)	2 (1)	

revised cardiac risk index (RCRI). In the entire cohort, both for models adjusted only for medication use and models also adjusting for patient and surgical factors, the only significant association with the main outcome of MACCE was a protective association with statin use in fully adjusted analyses of the overall cohort (MedUse-Adjusted OR 0.91 95% CI 0.78–1.05; Fully-Adjusted OR 0.84, 95% CI 0.73–0.98). Among the separate outcomes comprising MACCE, the only significant associations were between perioperative statin usage and decreased 30-day mortality both in the overall cohort (MedUse-Adjusted OR 0.60, 95% CI 0.45–0.80; Fully-Adjusted OR 0.60, 95% CI 0.45–0.81) and among patients with RCRI ≥3 (MedUse-Adjusted OR 0.60, 95% CI 0.42–0.85; Fully-Adjusted OR 0.60, 95% CI 0.41–0.87). While some of the stratified analyses are limited by small sample size, the estimated odds ratios of mortality with perioperative statin use are consistent for patients with

RCRI = 2 (Fully-Adjusted OR 0.58, 95% CI 0.32–1.02), though not statistically significant. In analyses limited to patients who had an MI within two years prior to surgery (n = 7789), the association of perioperative statin use with decreased mortality persisted (MedUse-Adjusted OR 0.56, 95% CI 0.38–0.84; Fully-Adjusted OR 0.59, 95% CI 0.39–0.89), but there was no observed association between either beta blocks or statin use and MACCE (BB: MedUse-Adjusted OR 0.97, 95% CI 0.79–1.19; Fully-Adjusted OR 0.86, 95% CI 0.70–1.06; Statins: MedUse-Adjusted OR 0.94, 95% CI 0.76–1.15; Fully-Adjusted OR 0.84, 95% CI 0.68–1.03).

4. Discussion

This study examines the associations of perioperative BB and statin use with 30-day MACCE and mortality in a national VA cohort

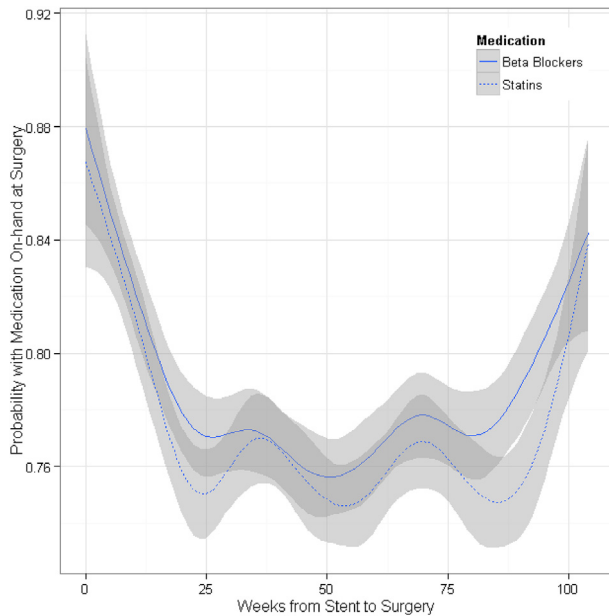


Fig. 1. Perioperative use of statins and beta-blockers by time between stenting and surgery.

Table 2

Unadjusted associations of perioperative beta blocker and statin use, and usage patterns with study outcomes of major adverse cardiac or cerebrovascular events (MACCE), mortality, myocardial infarction (MI), revascularization, and stroke.

		MACCE		Mortality		MI		Revascularization		Stroke	
Number of Events, (Rate%)		1182 (5.7%)		262 (1.3%)		557 (2.7%)		150 (0.7%)		362 (1.8%)	
		N (%)	p-value	N (%)	p-value	N (%)	p-value	N (%)	p-value	N (%)	p-value
Perioperative	None	149 (7.1)		41 (2.0)		67 (3.2)		16 (0.8)		47 (2.2)	
	BB Only	159 (6.0)		49 (1.9)		69 (2.6)		15 (0.6)		43 (1.6)	
	Statin Only	126 (5.4)	0.03	24 (1.0)	<0.001	56 (2.4)	0.41	15 (0.6)	0.68	41 (1.7)	0.35
	BB and Statin	748 (5.5)		148 (1.1)		365 (2.7)		104 (0.8)		231 (1.7)	
BB Usage	Chronic Use	1051 (5.7)		237 (1.3)		486 (2.6)		132 (0.7)		328 (1.8)	
	Recent Initiation	110 (5.9)	0.42	21 (1.1)	0.82	61 (3.3)	0.18	16 (0.9)	0.78	27 (1.4)	0.37
	Discontinued	21 (7.5)		4 (1.4)		10 (3.6)		2 (0.7)		7 (2.5)	
Statin Usage	Chronic Use	1018 (5.6)		219 (1.2)		470 (2.6)		131 (0.7)		326 (1.8)	
	Recent Initiation	143 (7.2)	0.005	39 (2.0)	0.02	74 (3.7)	0.001	18 (0.9)	0.51	30 (1.5)	0.56
	Discontinued	21 (7.8)		4 (1.5)		13 (4.8)		1 (0.4)		6 (2.2)	

Table 3

Logistic Regression Models for outcomes by perioperative beta blocker and statin use: overall and stratified by revised cardiac risk index (RCRI).

Medication	MACCE		Mortality		MI	Revascularization	Stroke
	MedUse-Adjusted	Fully-Adjusted	MedUse-Adjusted	Fully-Adjusted	Fully-Adjusted	Fully-Adjusted	Fully-Adjusted
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Overall Cohort							
N = 20579							
Beta Blocker	0.99 (0.85–1.15)	0.92 (0.79–1.08)	0.95 (0.70–1.30)	0.86 (0.62–1.17)	0.95 (0.76–1.19)	1.06 (0.69–1.63)	0.90 (0.69–1.18)
Statin	0.91 (0.78–1.05)	0.84 (0.73–0.98)	0.60 (0.45–0.80)	0.60 (0.45–0.81)	0.95 (0.76–1.15)	1.06 (0.69–1.63)	0.94 (0.71–1.23)
RCRI = 1							
N = 7973							
Beta Blocker	1.44 (0.98–2.12)	1.36 (0.92–2.01)	1.40 (0.50–3.94)	1.27 (0.43–3.70)	0.98 (0.60–1.58)	1.20 (0.54–2.67)	2.64 (0.88–7.89)
Statin	0.98 (0.68–1.40)	0.89 (0.62–1.27)	0.84 (0.32–2.17)	0.87 (0.32–2.37)	0.84 (0.53–1.34)	0.81 (0.37–1.75)	0.72 (0.32–1.64)
RCRI = 2							
N = 6776							
Beta Blocker	0.86 (0.65–1.14)	0.79 (0.60–1.04)	1.03 (0.55–1.92)	0.91 (0.48–1.74)	0.72 (0.48–1.07)	0.96 (0.44–2.09)	0.69 (0.42–1.13)
Statin	1.08 (0.81–1.43)	0.99 (0.74–1.31)	0.61 (0.35–1.07)	0.58 (0.32–1.02)	1.28 (0.84–1.96)	1.27 (0.57–2.85)	1.06 (0.63–1.80)
RCRI ≥ 3							
N = 5830							
Beta Blocker	0.94 (0.76–1.17)	0.91 (0.73–1.13)	0.89 (0.61–1.30)	0.84 (0.56–1.25)	1.10 (0.78–1.55)	1.19 (0.59–2.40)	0.89 (0.63–1.26)
Statin	0.85 (0.69–1.05)	0.84 (0.68–1.03)	0.60 (0.42–0.85)	0.60 (0.41–0.87)	0.97 (0.70–1.35)	1.35 (0.67–2.71)	1.01 (0.72–1.43)

Items in bold face are significant at the p<0.05 level.

of patients undergoing surgery after coronary stenting with prior use of both drug classes. The primary finding is that in adjusted analyses, decreased MACCE rates were significantly related to perioperative usage of statins, but not BB in adjusted analyses. Statin use was also associated with lower 30-day mortality.

Numerous studies have shown a protective association between perioperative BB use and adverse outcomes, particularly cardiac events, after non-cardiac surgery. Several large retrospective studies^{3,9} showed tendencies toward dose-dependent protective associations as cardiac risk increased. The POISE study, a multi-center randomized trial, showed that while cardiac events decreased, the risk of perioperative stroke increased for patients exposed to new onset BB therapy at the time of surgery.² The POISE trial explicitly excluded patients currently prescribed beta blockers prior to study entry and the observational studies included both BB naïve patients and those with chronic therapy, increasing the risk of selection bias despite best analytic methods. Two recent observational studies have focused on BB continuation.^{14,15} The first by Kwan et al. was limited to 1976 patients undergoing bariatric and colorectal procedures but identified increased risk of combined adverse events among patients whose BB were not continued perioperatively. The second, a study using VA Surgical Care Improvement Program data, found that while there was no protective association with BB continuation prior to surgery,

continuation in the post-operative period was associated with decreased cardiac events and 30-day mortality. The current study's observed lack of association between MACCE and mortality with BB use prior to surgery is consistent with the VA study but conflicts with the Kwon study.

Studies of perioperative statin use have largely suggested positive associations between use and improved outcomes after non-cardiac surgery.^{3,8,16} However, most randomized controlled trials were limited to patients not taking statins prior to enrollment and focused on cardiac surgery.^{8,17} The overall positive findings in the literature agree with the observations in this study where preoperative or postoperative statin use is associated with a lower risk of 30-day mortality.^{3,4,6} Although Table 2 suggests an increased risk of MACCE, mortality and MI among patients with recently initiated statins, further adjusted analyses showed no significant associations between the usage patterns and study outcomes in full adjusted models including perioperative use. In stratified analysis, risk of mortality was particularly high among patients with recently initiated statins but without perioperative use, confirming the importance of perioperative use.

Overall, perioperative beta blocker and statin use in this population was high. However, the figure shows that usage followed a U-shaped distribution declining from >85% right after stent placement to approximately 76% at one year and then increasing above 90% by two years after stent placement. While the initial decline was expected the subsequent increase was unanticipated. Nevertheless, this trend persisted with multivariate adjustment and after careful scrutiny of the data to detect any bias that might have come from the cohort's construction. Recognizing that contemporary clinical guidelines were to delay elective surgery up to a year after stent placement for drug eluting stents, our best hypothesis is that the later surgeries tended to be planned further in advance to follow these guidelines. This advance planning may have included additional preoperative clinical scrutiny and clinic visits with both surgeons and cardiologists. This increased attention could well have resulted in more patients having current medications on-hand at the time of surgery. Unfortunately, this explanation, remains conjectural because the necessary clinical data to verify it was beyond the scope of this study.

This study has several important strengths including its national cohort of patients undergoing a broad range of surgical procedures all of whom had elevated cardiac risk, as evidenced by prior stent placement, and all of whom had been prescribed both a statin and a BB in the year prior to surgery and with a wealth of demographic, procedure, pharmacologic and comorbidity data from both the VA and CMS. Thus, unlike other studies which examined patients administered perioperative medications restricted to those without prior exposure or with no information about prior exposure, this cohort was both large and potentially reduced the confounding by indication inherent in observational studies by including only patients with prior prescriptions for both BB and statins.

There are also important limitations to be acknowledged. As a VA study, the patient population was overwhelmingly male, largely white, and relatively aged, so findings may not generalize to different demographic groups undergoing surgery. In this study medication use was analyzed by class so that neither individual medication choices nor dosages were included. As such, no conclusions can be drawn about particular treatment options within each drug class or whether treatment was adequate. Another limitation is that for the majority of patients who are admitted on the day of surgery, we were unable to discern whether they were actually taking their medication only that pharmacy data indicates that they had medication on hand. This is a general limitation when evaluating outpatient drug therapy, shared by other studies.¹⁸ It should also be noted that within the scope of this study we could

not ascertain postoperative medication use, further complicated by the fact that statins are only available in oral formulations so that postoperative statin use would be confounded by the ability to take oral medications. Despite the comprehensive data, no observational study can claim to have eliminated the possibility of confounding by indication.

5. Conclusion

In conclusion, results from this study suggest that maintaining statin therapy perioperatively, is associated with decreased risk of 30 day mortality in stented patients undergoing non-cardiac surgery who have previously been prescribed both beta blockers and statins. Overall, medication use is high and there may be little opportunity to further improve outcomes for this challenging patient population with medication management.

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