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Treatment Approaches and Outcomes for Acute Anterior Circulation Stroke Patients with Tandem Lesions

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Abstract

Objectives: Endovascular thrombectomy (EVT) has revolutionized stroke care for large vessel occlusions (LVOs). However, over half treated remain functionally disabled or die. Patients with tandem lesions, or severe stenosis/occlusion of the cervical internal carotid artery (ICA) with intracranial LVO, may have technical EVT challenges and worse outcomes. We sought to compare treatments and outcomes for patients with anterior circulation tandem lesions versus isolated LVOs.

Materials and Methods: Consecutive tandem lesion and isolated LVO patients were identified at a single center. Demographics, medical history, presentations, treatments, and outcomes were collected and analyzed.

Results: From 381 EVT patients, 62 had tandem lesions related to atherosclerosis (74%) or dissection (26%). Compared to isolated intracranial LVOs, they were younger (63 vs 70, p=0.003), less atrial fibrillation (13% vs 40%, p<0.0001), less adequate reperfusion (TICI 2b-3, 58% vs 82%, p<0.0001), more intracranial hemorrhage (ICH, 13% vs 5%, p=0.037), but similar 90-day functional independence (mRS 0–2, 34% vs 43%, p=0.181). The cervical ICA was treated before intracranial EVT (57%), after (13%), not acutely (22%), or was inaccessible (8%). Acute cervical ICA treatments were stenting (57%) or angioplasty alone (13%). Neither acute stenting nor order of treatment was associated with outcomes (TICI 2b-3, ICH, or 90-day mRS 0–2). Among acutely stented, neither alteplase nor antiplatelets were associated with outcomes or stent patency.

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Conclusions: Tandem lesions were associated with less reperfusion, more ICH, but similar 90-day functional independence. No treatment approach was associated with outcomes. These data illustrate the technical challenges of tandem lesion treatment and underscore the importance of developing new approaches.

Keywords

Acute ischemic stroke; Endovascular thrombectomy; Tandem lesions; Carotid stenosis; Large vessel occlusion; Carotid stenting

Introduction

Stroke is among the leading causes of death and disability worldwide, with ischemic stroke due to large vessel occlusion (LVO) accounting for the largest proportion of this burden.(1,2) The care of these patients was revolutionized with the widespread adoption of endovascular thrombectomy (EVT).(3,4) Despite the robust efficacy of EVT, over 50% of those treated are left functionally disabled or dead at 90 days.(3,5) Ongoing research efforts aim to optimize EVT to improve reperfusion rates and outcomes for LVO stroke. Tandem lesions represent one subtype of LVO with technical EVT challenges, heterogenous approaches, and likely worse outcomes.(6,7) Tandem lesions are defined by severe stenosis or occlusion of the cervical internal carotid artery (ICA), related to atherosclerosis or dissection, and occlusion of a large intracranial artery, most often the middle cerebral artery (MCA).(8)

Among all patients with acute ischemic stroke from LVO, 10–15% present with tandem lesions.(9,10) Compared to isolated intracranial LVOs, less is understood about their presentation, clinical course, best management, and rates of adverse events.(6,11) While data support the treatment of both the intracranial and the cervical ICA lesions,(6,9,12,13) it remains unclear which should be addressed first.(10) Furthermore, there is varied practice regarding acute cervical ICA angioplasty with or without stenting vs delayed treatment at an interval.(10,14) There is also considerable variability in intra-procedural and periprocedural antiplatelet regimens. While stenting is associated with the risks of restenosis and thrombotic complications, antiplatelet therapy presents the risk of intracerebral hemorrhage (ICH),(9,10,13,15) perhaps more so in conjunction with thrombolytic therapy for acute stroke.(16) We sought to evaluate stroke etiology, treatment approaches, and outcomes for patients who presented with acute ischemic stroke due to tandem lesions for comparison with isolated intracranial occlusions.

Methods

Patients who had intracranial anterior circulation LVOs and severe cervical ICA stenosis/occlusions, defined as tandem lesions, that underwent EVT from January 2011 to September 2019 were identified retrospectively from a prospectively maintained database at a single center.(17) This database includes demographic information, medical history, clinical presentation, treatments, and outcomes for consecutive patients treated with EVT. Additional details about the cervical ICA endovascular treatment approach and follow-up patency were obtained by retrospective chart review of procedure notes, progress notes, imaging, and other documentation.

Alteplase treatment decisions were at the discretion of a vascular neurologist. EVT and endovascular cervical ICA treatment decisions were at the discretion of the treating neurointerventionalist. Patients treated with first generation EVT devices (Merci, n=2) were omitted from treatments and outcomes analyses to improve generalizability. Acute cervical ICA treatments were defined as treatments occurring before or immediately after intracranial EVT, including balloon angioplasty and stenting. While the approach for each case was neurointerventionalist-dependent, a general approach was adopted to reserve acute stenting for those with stenosis >90%. Antiplatelet regimens also varied, but were primarily aspirin monotherapy, often for the cases in which intravenous alteplase was administered, or dual antiplatelet therapy with aspirin and clopidogrel, often after a period of treatment with intravenous eptifibatide.

Cervical ICA severe stenosis was defined as stenosis >70% by NASCET criteria.(18) Cervical ICA stenosis/occlusion could be related to atherosclerosis or dissection, which were defined by the presence or absence of calcium on CT and the vessel appearance on angiography. Thrombolysis in Cerebral Infarction (TICI) scores were determined by the neurointerventionalist using the modified scale: 2a partial filling <50%, 2b partial filling ≥50%, 3 complete perfusion.(3) Adequate reperfusion was defined as TICI 2b-3. ICH was defined as any symptomatic PH1 or PH2 by ECASS criteria during the hospitalization.(3) NIH Stroke Scale (NIHSS) was determined as described,(3) with higher numbers reflecting increased clinical stroke severity. 90-day modified Rankin Scale (mRS) was assessed, available for 55/62 patients.(19,20) Functional independence was defined as mRS 0–2.

Median and interquartile range were reported for continuous variables. Percent and count were reported for categorical variables. Differences were assessed using nonparametric Wilcoxon rank-sum for continuous variables and Fisher’s Exact tests for categorical variables. Logistic regression was performed for dichotomous dependent outcome variables. Two-tailed P values <0.05 were interpreted as statistically significant. Analyses were performed with SPSS version 23.0 (IBM Corp). This study was approved by the local institutional review board. Informed consent was waived based on minimal patient risk and practical inability to perform the study without the waiver. The data that support the findings of this study are available from the corresponding author upon request.

Results

From 381 consecutive patients with anterior circulation LVOs treated with EVT over the study period, 62 were identified with tandem lesions related to atherosclerosis (74%) or dissection (26%). Compared to those with isolated intracranial LVOs, patients with tandem lesions were younger (63 vs 70 years, p=0.003), had less atrial fibrillation (13% vs 40%, p<0.0001), and more carotid terminus intracranial LVOs (34% vs 15%, p=0.001). Other demographics, medical history, and clinical presentations were similar (Table 1).

Regarding treatment approach, intravenous (IV) alteplase was administered to a similar percentage of patients with tandem lesions vs isolated intracranial LVOs (65% vs 55%, p=0.157). The last known well (LKW)-to-alteplase time was similar between these groups (120 vs 112 min, p=0.323), but the LKW-to-groin puncture time was slightly longer (328 vs

267 min, p=0.018) for those with tandem lesions. Among those with tandem lesions, intracranial treatments included at least one aspiration pass (58%), at least one stentriever pass (47%), and/or at least one Merci pass (3%, omitted from outcomes analyses). There was a trend towards patients with tandem lesions undergoing more intracranial EVT passes (2 vs 1, p=0.087). The manner of acute cervical ICA treatment was as follows: treatment before intracranial EVT (57%), after intracranial EVT (13%), no acute treatment (22%), or was inaccessible (8%). Acute cervical ICA treatments were stenting (81% treated, 57% total) or angioplasty alone (19% treated, 13% total). Of those with acute cervical ICA treatment deferred, 38% had complete occlusion on follow-up imaging, 23% had only mild stenosis and were not treated, 15% underwent delayed endarterectomy, 15% had care goals changed, and 8% were lost to follow-up. Compared to those with isolated intracranial LVOs, patients with tandem lesions were less likely to achieve TICI 2b-3 reperfusion (58% vs 82%, p<0.0001), more likely to have ICH (13% vs 5%, p=0.037), but similarly likely to reach 90-day functional independence (mRS 0–2, 34% vs 43%, p=0.288) with similar mortality (23% vs 22%; Table 2).

Excluding patients for whom the cervical ICA was inaccessible, the underlying pathology of cervical stenosis did not determine the likelihood of acute stenting (dissection vs atherosclerosis, p=0.775, OR=1.20, 95%CI=0.34–4.19), adequate reperfusion (p=0.334, OR=0.55, 95%CI=0.16–1.85), ICH (p=0.876, OR=0.87, 95%CI=0.16–4.88), or 90-day functional independence (p=0.880, OR=1.11, 95%CI=0.30–4.10). In addition, the decision to acutely stent was not associated with adequate reperfusion (p=0.874, OR=0.91, 95%CI=0.29–2.87), ICH (p=0.475, OR=1.86, 95%CI=0.34–10.24), or 90-day functional independence (p=0.479, OR=0.64, 95%CI=0.19–2.19). The number of passes was also not associated with adequate reperfusion (p=0.163, OR=0.65, 95%CI=0.36–1.19), ICH (p=0.167, OR=0.44, 95%CI=0.14–1.41), or 90-day functional independence (p=0.641, OR=0.87, 95%CI=0.48–1.57). Furthermore, the order of cervical ICA treatment, prior to intracranial LVO treatment, post intracranial LVO treatment or deferred, was not associated with adequate reperfusion (p=0.347, OR=0.57, 95%CI=0.18–1.84), ICH (p=0.138, OR=5.19, 95%CI=0.59–45.58), or 90-day functional independence (p=0.879, OR=1.10, 95%CI=0.32–3.75; Table 3).

For patients who underwent acute cervical ICA stenting before or immediately after EVT, IV alteplase was administered to 77% and periprocedural antiplatelets to 66% [DAPT (35%), aspirin (87%), eptifibatide (35%), clopidogrel (13%), ticagrelor (4%), and abciximab (4%)]. All those not administered an antiplatelet were previously treated with alteplase. Heparin was administered to 6%, all of which were also treated with an antiplatelet. Follow-up imaging by CT angiography or duplex ultrasonography after acute stenting was available for 65% and showed 55% were patent after median 7 days (IQR 1–70). Among those acutely stented, alteplase treatment was not associated with differences in adequate reperfusion (p=0.103, OR=3.96, 95%CI=0.76–20.67), ICH (p=0.507, OR=0.52, 95%CI=0.08–3.56), 90-day functional independence (p=0.764, OR=1.32, 95%CI=0.21–8.24), or stent patency (p=0.653, OR=0.56, 95%CI=0.04–7.21). Any method of acute antiplatelet treatment was not associated with differences in adequate reperfusion (p=0.260, OR=2.29, 95%CI=0.54–9.63), ICH (p=0.380, OR=0.45, 95%CI=0.07–2.68), 90-day functional independence (p=0.204, OR=3.12, 95%CI=0.54–17.97), or stent patency (all patients with non-patent stents received an antiplatelet). Other detailed antiplatelet analyses are shown (Table 3).

Discussion

In this retrospective cohort, patients presenting with tandem lesions had significantly different presentations and outcomes compared to those with isolated intracranial LVOs; they were younger, had less atrial fibrillation, less often experienced adequate angiographic reperfusion, more often experienced ICH, but had similar 90-day functional independence. Among those with tandem lesions, outcomes were similar whether cervical ICA lesions were from atherosclerosis or dissection, whether they were treated before or after intracranial EVT, and whether or not they were stented acutely. Furthermore, 55% of cervical ICA stents remained patent on follow-up. Among those stented, neither IV alteplase nor any antiplatelet approach was associated with differences in outcomes.

In regard to clinical presentation, 16% of patients with acute stroke secondary to anterior LVO who presented for EVT in our series had tandem lesions, a proportion similar to the 13–15% cited elsewhere.(9,10) Seventy-four percent of the tandem lesions in our series were caused by cervical ICA atherosclerotic disease, and the remaining 26% by ICA dissection. This distribution was similar to other reports describing 82%(9) and 77%(6) of tandem cases attributed to atherosclerotic disease. Patients presenting with acute stroke due to tandem lesions were less likely to have a diagnosis of atrial fibrillation (pre-existing or diagnosed during hospitalization) and were on average several years younger. These differences are perhaps not surprising and likely reflect tandem lesion disease pathophysiology, originating secondary to cervical ICA atherosclerosis or dissection-related thrombosis with distal embolization.(9) Atrial fibrillation and cardioembolic stroke have been described as being associated with advanced age,(21) while dissection more likely presents in younger populations.(22) The slightly longer LKW-to-groin time for patients with tandem lesions is not easily explained given they underwent the same pre-EVT triage process and imaging.(23)

Regarding outcomes, we analyzed adequate reperfusion (TICI 2b-3), ICH, and 90-day functional independence (mRS 0–2). Adequate reperfusion was achieved in 58% of tandem lesion patients and 82% of patients with isolated intracranial LVOs. Other series have also reported lower rates of adequate reperfusion associated with tandem lesions.(24) One large study demonstrated adequate reperfusion rates of 83% when cervical ICA stenting was implemented.(16) Others have described reperfusion rates of 77%,(6) 81%,(11) and 87%.(9) The literature regarding reperfusion rates after EVT for tandem lesions is varied, perhaps related to inclusion criteria, endovascular approach, antithrombotic choice, and dates over which studies were conducted given advances in technology.(24)

ICH is another key outcome to consider for these patients; it occurred in 13% of patients with tandem lesions in our series. This is similar to rates in other series of tandem lesions which describe 10%(11,15) but as high as 33% among those given abciximab.(15) This rate was significantly higher than that of isolated intracranial LVOs in our series (5%), a finding also observed by others.(11,15) There are several possible explanations for this increase.

Tandem lesions treated with cervical ICA stents may require immediate and continued antiplatelet therapy. This can pose substantial risk especially in the setting of IV thrombolysis. Furthermore, some have proposed that sudden recanalization of chronic ICA atherosclerosis-related stenosis may precipitate discrepant reperfusion injury of hypoperfused brain regions.(15) A final consideration is that cervical ICA lesions are sometimes treated first before intracranial EVT, prolonging the time to intracranial reperfusion and thus the duration of ischemic injury.(9)

The gold standard stroke outcome, 90-day disability, was not significantly different comparing those with tandem lesions to isolated intracranial LVOs (mRS 0–2 was 34% vs 43%, p=0.181) in our series. Like other outcomes reported for tandem lesions, there is a wide range reported in the literature likely dependent on several factors. Functional independence at 90 days has been reported to occur in 40%,(16) 46%,(25) 52%,(6) 56%,(8) 58%,(16) and 73%(9) after EVT for tandem lesions. Furthermore, some have shown functional independence is less likely for patients presenting with tandem lesions compared to isolated intracranial LVOs (18% vs 68%).(11)

Regarding treatment approaches, we analyzed order and mode of acute cervical ICA endovascular treatment, IV thrombolysis, and antithrombotic agents. There is no consensus on the best order of cervical ICA endovascular treatment (*i.e.*, cervical treatment first vs intracranial treatment first). In the present series, the cervical ICA was treated before the intracranial LVO in 57%, after the intracranial LVO in 13%, and deferred for delayed treatment in 22%. No approach was associated with a difference in any of the aforementioned outcomes. Some reports comparing these approaches argue that cervical treatment first can result in easier access to intracranial lesions, less acute non-target periprocedural thromboembolism, and higher rates of adequate reperfusion (TICI 2b-3). (9,12,26) Intracranial-first techniques, on the other hand, have been favored by others as they offer a shorter time to intracranial reperfusion.(9) A recent series of tandem lesions showed that intracranial-first approaches were associated with more adequate reperfusion (92% vs 56%) and functional independence (44% vs 30%).(27)

Acute cervical ICA stenting is also a source of much debate. 57% of cases included here received an ICA stent acutely at the time of the emergent EVT while 15% of cases were treated with angioplasty alone. This is similar to other reports, including the TITAN study which showed 66% of tandem lesions were acutely stented, and 14% underwent angioplasty alone.(6) Acute stenting was not associated with differences in reperfusion, ICH, or 90-day mRS in our series. This is in contrast to one report that showed more frequent functional independence among those acutely stented (68% vs 42%).(28) Among the 34 patients treated with cervical ICA stents in this series, 22 had follow-up cervical vessel ICA imaging available, of which 12 were patent after median 7 days. While this may reflect some selection bias as perhaps patients were more likely to be imaged if they experienced symptoms related to occlusion and some patients were followed elsewhere, this rate of patency is lower than that reported in other series. A smaller series of patients with tandem lesions showed patency in 17 of 18 stents at 90 days.(15) It is important to note that there are many variables that may be related to stent patency but an important one is antithrombotic and antiplatelet therapy in the periprocedural period. One may not expect to achieve the rates of patency exceeding 90% that have been reported for ICA stenting in elective settings.(29) The alternative to acute stenting is to defer for a time interval but ultimately treat the cervical ICA with stenting or endarterectomy in delayed fashion. For cases with little concern for hypoperfusion and cerebral ischemia related to cervical ICA stenosis after intracranial EVT, delayed treatment may offer the best balance of thrombotic versus hemorrhagic risks.(10)

In our series, neither periprocedural antiplatelet administration nor alteplase administration was associated with stent patency on follow-up imaging. 66% of those stented received a periprocedural antiplatelet agent, most often including aspirin (87%). All who did not receive an antiplatelet agent were previously treated with IV alteplase, and all cases of stent occlusion occurred in those who had received at least one periprocedural antiplatelet agent. Furthermore, there was no association of stent patency with dual antiplatelet therapy (DAPT) or specific agents, but sample sizes were small and approaches varied, necessitating further study. There are many different antiplatelet regimens reported in the literature, from DAPT with aspirin and Plavix(8,30) to aspirin and abciximab.(15)

For patients who underwent stenting in our series, antithrombotic therapy was not associated with differences in other outcome measures either, including ICH and 90-day mRS. This is in contrast to reports of stent placement and antiplatelet administration being associated with ICH.(11,15) Another series, however, found an overall low ICH rate (4.4%) and no increase among those who received periprocedural DAPT with stenting.(9) 65% of patients with tandem lesions in our series received IV alteplase before EVT; this rate was not significantly different compared to isolated intracranial LVOs. IV alteplase was also not associated with differences in outcomes. None of the reviewed literature compared rates of ICH among patients with tandem lesions who received alteplase or did not and then went on to receive antiplatelets associated with stenting. Further investigation is warranted as the role for alteplase in LVO treatment in general is unclear.(31)

There are several limitations of this study. First, the sample size is relatively small, limiting statistical power to draw some conclusions particularly about specific antiplatelet regimens. Second, as a retrospective observational series, patients were not randomized, and there is risk of selection bias. Treatment approaches were at the discretions of treating clinicians. Treatments themselves were often variable with different periprocedural antiplatelet regimens and stent manufacturers utilized. The catchment area represents a primarily Caucasian population which may limit generalizability. Furthermore, this study includes patients treated from 2011–2019, a period over which device technology advancements and several practice-changing trials were published that could have influenced treatment decisions. However, patients treated with first generation devices were excluded from treatment and outcomes analyses. There was also moderate attrition as several patients were seen outside our hospital system for follow-up and/or had only short-term assessments of post-procedural ICA patency.

In conclusion, tandem lesions, three-fourths caused by atherosclerosis and a fourth by dissection, were associated with younger age, less atrial fibrillation, less adequate reperfusion, more ICH, but similar 90-day functional independence and mortality, when compared to isolated intracranial occlusions. 55% of stents were patent on follow-up imaging. Neither underlying etiology, acute stenting at the time of EVT, nor, if treated acutely, the order of ICA treatment in relation to intracranial EVT were associated with differences in outcome measures. These data illustrate the technical challenges of tandem lesion treatment and underscore the importance of developing new approaches. While tandem lesion etiology is becoming better understood, further work is needed to optimize technical approaches, patient selection for acute stenting, and antiplatelet strategies that balance the risks of stent occlusion vs ICH.

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Table 1.

Demographics, medical history, and clinical presentations of patients with tandem lesions versus isolated intracranial large vessel occlusions. Count (percent) reported unless noted otherwise. Abbreviations: IQR interquartile range, TIA transient ischemic attack, NIHSS NIH stroke scale, ICA internal carotid artery, M1 first segment of middle cerebral artery, M2 second segment of middle cerebral artery.

	Tandem Lesion (N=62)	Isolated Intracranial (319)	P
Age, Median (IQR)	63 (54–74)	70 (59–81)	0.003
Female	24 (39%)	169 (53%)	0.051
Atrial Fibrillation	8 (13%)	128 (40%)	<0.0001
Diabetes	14 (23%)	65 (20%)	0.732
Hypertension	39 (63%)	217 (68%)	0.461
Coronary Disease	12 (19%)	74 (23%)	0.619
Stroke/TIA	9 (15)	59 (19%)	0.587
Smoking	17 (27%)	55 (17%)	0.075
NIHSS, Median (IQR)	16 (14–21)	17 (13–20)	0.776
Cervical ICA Lesion			
Atherosclerosis	46 (74%)	-	-
Dissection	16 (26%)	-	-
Intracranial Occlusion			
ICA Terminus	21 (34%)	49 (15%)	0.001
M1	37 (60%)	225 (71%)	0.101
M2	4 (6%)	44 (14%)	0.143

Table 2.

Treatments and outcomes of patients with tandem lesions versus isolated intracranial large vessel occlusions. Count (percent) reported unless noted otherwise. N=60 unless otherwise specified. Abbreviations: LKW last known well, IQR interquartile range, ICA internal carotid artery, TICI Thrombolysis in Cerebral Infarction score, ICH intracerebral hemorrhage, mRS modified Rankin scale score.

	Tandem Lesion (N=60)	Isolated Intracranial (319)	P
LKW-to-Alteplase Min, Median (IQR)	120 (92–163)	112 (83–156)	0.323
Intravenous Alteplase	39 (65%)	174 (55%)	0.157
LKW-Groin Min, Median (IQR)	328 (197–425)	267 (180–368)	0.018
Acute Treatment Approach			
Cervical ICA Before Intracranial LVO	34 (57%)	-	
Cervical ICA After Intracranial LVO	8 (13%)	-	
No Cervical ICA Acute Treatment	13 (22%)	-	
Cervical ICA Inaccessible	5 (8%)	-	
Acute Treatment Type (N=42)			
Cervical ICA stent	34 (81%)	-	
Cervical ICA angioplasty alone	8 (19%)	-	
Number EVT Passes, Median (IQR)	2 (1–2)	1 (1–1.5)	0.087
TICI 2b-3	35 (58%)	263 (82%)	<0.0001
ICH	8 (13%)	16 (5%)	0.037
Follow-Up Stent Patency (N=22)	12 (55%)	-	-
90-Day mRS 0–2	18 (34%)	121 (43%)	0.288
90-Day Mortality	12 (23%)	62 (22%)	0.859

Table 3.

Associations with outcomes: adequate reperfusion (Thrombolysis in Cerebral Infarction, TICI 2b-3), intracerebral hemorrhage (ICH), and 90-day functional independence (modified Rankin scale, mRS 0–2). #All patients with occluded stents received at least one antiplatelet agent. Abbreviations: ICA internal carotid artery, DAPT dual antiplatelet therapy, OR odds ratio, CI confidence interval.

	TICI 2b-3		ICH		90-Day mRS 0–2		Stent Patency	
	P	OR (95%CI)	P	OR (95%CI)	P	OR (95%CI)	P	OR (95%CI)
Among Accessible ICAs (N=55)								
Dissection (15) vs Atherosclerosis	0.334	0.55 (0.16–1.85)	0.876	0.87 (0.16–4.88)	0.880	1.11 (0.30–4.10)	-	-
Stenting (34) vs Not	0.874	0.91 (0.29–2.87)	0.475	1.86 (0.34–10.24)	0.479	0.64 (0.19–2.19)	-	-
Cervical ICA First (34) vs Last/Deferring	0.347	0.57 (0.18–1.84)	0.138	5.19 (0.59–45.58)	0.879	1.10 (0.32–3.75)	-	-
Number EVT Passes	0.163	0.65 (0.36–1.19)	0.167	0.44 (0.14–1.41)	0.641	0.87 (0.48–1.57)	-	-
Among Stented (N=34)								
Alteplase Treatment (27)	0.103	3.96 (0.76–20.67)	0.507	0.52 (0.08–3.56)	0.764	1.32 (0.21–8.24)	0.653	0.56 (0.04–7.21)
Any Antiplatelet (23)	0.260	2.29 (0.54–9.63)	0.380	0.45 (0.07–2.68)	0.204	3.12 (0.54–17.97)	0.999	#
Aspirin (20)	0.316	2.04 (0.51–8.23)	0.699	0.71 (0.12–4.11)	0.619	1.46 (0.33–6.46)	0.157	0.25 (0.04–1.70)
DAPT (8)	0.981	0.98 (0.19–5.01)	0.507	1.92 (0.28–13.08)	0.774	1.28 (0.24–6.70)	0.781	1.33 (0.18–10.12)
Eptifibatide (8)	0.396	0.50 (0.10–2.48)	0.507	1.92 (0.28–13.08)	0.568	0.59 (0.10–3.57)	0.463	0.47 (0.06–3.57)