Title
Association Between Ambulatory Status and Outcomes of Carotid Endarterectomy

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imaging to predict cardiovascular events and death. No analog exists within the vascular surgical literature. Using cross-sectional imaging on patients undergoing transcarotid arterial revascularization (TCAR), we used a previously published standardized, semiautomated technique to obtain atherosclerotic plaque calcium quantification. We examined the impact of carotid calcium volume percent on postoperative stroke/death, hypothesizing that increased calcium burden would be associated with increased stroke/death.

Methods: Patients who underwent TCAR from 2015 to 2023 were stratified into high- or low-calcium volume percent using the median value. Stroke and mortality dates were obtained from patient records. The primary outcome was composite stroke/death. Patient factors and outcomes were compared using Student's *t* test, Pearson's χ^2 test, Fisher's exact test, and the Mann-Whitney test. Kaplan-Meier analysis was performed for 3-year freedom from stroke/death and Cox proportional hazards modeling for factors associated with stroke/death.

Results: A total of 242 patients underwent TCAR from December 2015 to January 2023 at our institution. The high-calcium group had more female patients (38.0% vs 24.0%, $P = .03$), was older (74.6 ± 7.9 years vs 70.5 ± 9.4 years, $P < .01$), and had a higher rate of hypertension (95.0% vs 86.0%, $P = .03$). Rates of symptomatic disease were similar between the groups (41.7% high calcium vs 51.2% low calcium, $P = .17$). The mean calcium volume was 2.9% ± 2.8% for low calcium vs 20.7% ± 9.7% in the high calcium group ($P < .01$). Thirty-day stroke/death occurred only in the high-calcium group and was equivalent when stratified by symptomatic status (1.7% asymptomatic vs 3.3% symptomatic, $P = .23$). At 3 years, the low-calcium group demonstrated greater freedom from stroke/death ($P = .03$) (Fig). Mortality rate was higher in the high-calcium group (20.7% vs 9.1%, $P = .02$) though with fewer strokes (0.0% vs 2.5%, $P = .25$). Cox proportional hazards analysis showed that factors associated with stroke/death were congestive heart failure (hazard ratio [HR]: 4.5, 95% confidence interval [CI]: 2.3-9.0; $P < .01$) and chronic kidney disease (HR: 2.2, 95% CI: 1.1-4.3; $P = .03$). Low-calcium volume percent (HR: 0.5, 95% CI: 0.3-1.0; $P = .05$) was protective.

Conclusions: Using a novel volumetric technique for quantification of carotid plaque calcium burden, we demonstrated that lower calcium volume percent is associated with a lower combined stroke/death rate at 3 years. This may reflect that a higher carotid calcium burden is associated with greater systemic calcification and thus higher cardiovascular risk. In addition, a patient's comorbid profile is strongly associated with stroke/death in the midterm. These data provide additional anatomic-based data to aid in risk-benefit analysis in patients undergoing minimal access carotid surgery.

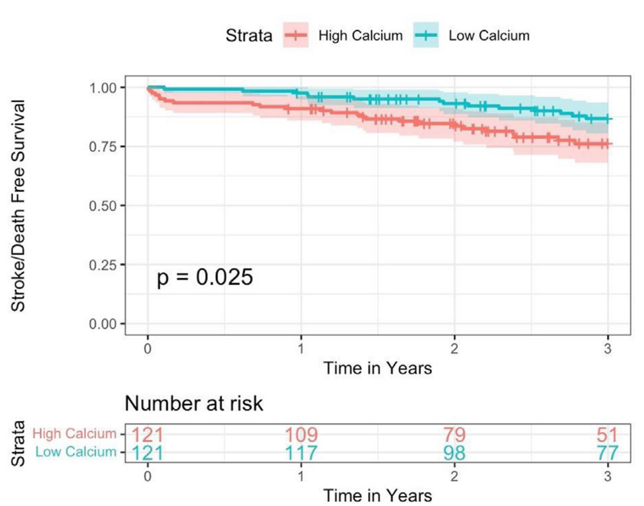

Fig. Kaplan-Meier analysis of 3-year freedom from stroke/death by high- and low-calcium volume percent.

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RS06

Carotid Disease Treatment Modality and Its Association With Postoperative Vasoactive Medication Utilization and Hospital Length of Stay

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Objective: Carotid artery disease is a major cause of stroke, and the standard treatment has traditionally been a combination of medical management and intervention, including both carotid endarterectomy (CEA) and transfemoral carotid artery stenting (TF-CAS). In recent years, transcarotid artery revascularization (TCAR) has also been adopted as a promising treatment after the Food and Drug Administration approval in 2015. In terms of stroke reduction, TCAR has been found to have equivalent outcomes with CEA with shorter operative times. A known side effect of TCAR is the stimulation of baroreceptors in the carotid bulb resulting in bradycardia and blood pressure variability that may require vasopressor support. This has the potential to lengthen both intensive care unit (ICU) and entire hospital stay. The goal of this retrospective cohort study was to determine whether there is a difference in postoperative vasopressor or vasodilator treatment between traditional CEA, TF-CAS, or TCAR and whether it affects ICU and/or overall hospital lengths of stay.

Methods: The Kaiser Permanente Southern California regional database was queried from January 2018 to December 2022 for all patients who underwent CEA, TF-CAS, or TCAR at any Southern California Permanente Hospital. χ^2 and Kruskal-Wallis tests were used to analyze patient characteristics and compare medication use and ICU and postintervention length of stay in each intervention modality.

Results: The regional database query yielded 2487 patients who had undergone CEA, TF-CAS, or TCAR. The postoperative inpatient length of stay for TCAR patients (2.4 days) was shorter than CEA (3.6 days) and TF-CAS (5.4 days) ($P < .0001$). The ICU length of stay was lower for TCAR (1.4 days) than both CEA (1.7 days) and TF-CAS (1.5 days) ($P < .0041$). TCAR patients were more likely to have any intravenous vasoactive medication (19.3%) compared with CEA (6%) and TF-CAS (7.8%) ($P < .0001$). Also, TCAR patients were more likely to have midodrine prescribed at any point in their hospitalization (9%) compared with CEA (0.3%) and TF-CAS (1.2%) ($P < .001$).

Conclusions: TCAR patients were more likely to require intravenous vasoactive medication postoperatively compared with CEA and TF-CAS. This is likely secondary to baroreceptor stimulation by the stent deployment. Further investigation to analyze why this is not as frequently seen with TF-CAS would be beneficial. Despite this, TCAR had reduced ICU and hospital lengths of stay. Combining these findings with already reported benefits makes TCAR an attractive option in the operative treatment of carotid artery stenosis.

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RS07

Association Between Ambulatory Status and Outcomes of Carotid Endarterectomy

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Objective: Ambulatory status of patients plays a pivotal role in surgical decision-making. Carotid endarterectomy (CEA) is the established gold standard for addressing carotid artery disease. We assessed the impact of ambulatory status on CEA outcomes, stratifying our analysis by symptomatic and asymptomatic status, in order to evaluate ambulatory status as a surrogate for surgical fitness.

Methods: We identified all patients who had undergone CEA from 2012 to 2023 in the Vascular Quality Initiative Database. We categorized patients by independent ambulatory status and nonambulatory (with

Table I. Select preoperative characteristics of ambulatory and nonambulatory patients

Preoperative characteristics	Ambulatory	Nonambulatory	Total	*P* value
Age, years, mean ± SD	70.67 ± 0.04	70.88 ± 0.39	70.6 ± 0.04	.3
BMI, mean ± SD	28.78 ± 0.48	29.11 ± 0.33	28.74 ± 0.44	.274
Hypertension	155,522 (89.4)	2105 (92.2)	157,627	<.001
Diabetes	63,188 (36.3)	1223 (53.6)	64,411	<.001
COPD	39,405 (22.7)	742 (32.5)	40,147	<.001
CHF	20,041 (11.5)	560 (24.5)	20,601	<.001
CAD	46,863 (27)	724 (31.7)	47,587	<.001
CKD	137,883 (79.3)	1561 (68.4)	139,444	<.001
ASA class 4/5	37,783 (21.7)	1002 (43.9)	38,785	<.001

BMI, Body mass index; *CAD*, coronary artery disease; *CHF*, congestive heart failure; *CKD*, chronic kidney disease; *COPD*, chronic obstructive pulmonary disease; *SD*, standard deviation.
P < .05 considered significant.
Data are presented as number (%) unless otherwise indicated.

Table II. Multivariable regression for ambulatory status, with ambulatory patients as comparison

	Total		Symptomatic		Asymptomatic	
	aOR (95% CI)	*P* value	aOR (95% CI)	*P* value	aOR (95% CI)	*P* value
Stroke	1.7 (1.2, 2.3)	<.001***	2.2 (1.5, 3.1)	<.001***	1.1 (0.6, 1.9)	.736
Death	2.2 (1.4, 3.5)	<.001***	2.4 (1.3, 4.3)	.003**	2.0 (1.0, 4.0)	.083
30-day mortality	2.6 (2.0, 3.4)	<.001***	2.6 (1.8, 3.8)	<.001***	2.6 (1.8, 3.8)	<.001***
Stroke/death	1.8 (1.4, 2.5)	<.001***	2.2 (1.6, 3.1)	<.001***	1.1 (0.7, 2.0)	.509

aOR, Adjusted odds ratio; *CI*, confidence interval.
Stratified by symptomatic status. Adjusting for confounding variables such as demographics (age, gender, race, and body mass index), comorbidities (hypertension, diabetes, chronic obstructive pulmonary disease, congestive heart failure, coronary artery disease, chronic kidney disease, dialysis, active smoking, ASA class 4/5, and 80% or greater degree of ipsilateral stenosis), urgency (elective, emergent, and urgent), and preoperative medications (P2Y inhibitor, statin, aspirin, beta blocker, ace inhibitor, and anticoagulant).
P value < .05 considered significant.
<.01, *<.001.

wheelchair and bedridden). We performed logistic regression to compare between procedures, adjusting for confounding variables such as demographics (age, gender, race, and body mass index), comorbidities (hypertension, diabetes, chronic obstructive pulmonary disease, congestive heart failure, coronary artery disease, chronic kidney disease, dialysis, active smoking, American Society of Anesthesiologists class 4/5, and 80% or greater degree of ipsilateral stenosis), urgency (elective, emergent, and urgent), and preoperative medications (P2Y inhibitor, statin, aspirin, β-blocker, ace inhibitor, and anticoagulant). Our primary outcomes were in-hospital stroke, death, 30-day mortality, and combined stroke/death.

Results: We identified 176,167 patients who underwent CEA, of whom 173,884 (98.7%) were ambulatory and 2283 (1.2%) were nonambulatory. Nonambulatory patients had more comorbidities such as hypertension (*P* < .001), diabetes (*P* < .001), chronic obstructive pulmonary disease (*P* < .001), congestive heart failure (*P* < .001), coronary artery disease (*P* < .001), and chronic kidney disease (*P* < .001), and were more likely to be symptomatic (*P* < .001). Compared with ambulatory patients, nonambulatory patients had significantly worse outcomes for stroke (adjusted odds ratio [aOR] = 1.7, 95% confidence interval [CI]: 1.2-2.3; *P* < .001), death (aOR = 2.2, 95% CI: 1.4-3.5; *P* < .001), 30-day mortality (aOR = 2.6, 95% CI: 2.0-3.4; *P* < .001), and combined stroke-death (aOR = 1.8, 95% CI: 1.4-2.5, *P* < .001). Symptomatic nonambulatory patients had over double the risk of stroke (aOR = 2.2, 95% CI: 1.5-3.1; *P* < .001), death (aOR = 2.4, 95% CI: 1.3-4.3; *P* = .003), 30-day mortality (aOR = 2.6, 95% CI: 1.8-3.8; *P* < .001), and stroke/death (aOR = 2.2, 95% CI: 1.6-3.1; *P* < .001). Asymptomatic nonambulatory patients had over two times the risk for 30-day mortality (aOR = 2.6, 95% CI: 1.8-3.8; *P* < .001).

Conclusions: Patient selection is crucial for CEA to optimize outcomes. Nonambulatory status was associated with worse outcomes, especially when observing outcomes of symptomatic patients. Careful consideration must be given for nonambulatory asymptomatic patients as they had significantly increased 30-day mortality with CEA. Although surgical intervention may be imperative for nonambulatory symptomatic patients, nonambulatory asymptomatic patients might be better served with aggressive medical management.

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SS06

Cranial Nerve Injuries After Carotid Endarterectomy: A 15-Year Prospective Study With Routine Otolaryngologist and Neurological Evaluation

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Objective: The aim of this prospective monocentric cohort study was to analyze the incidence of cranial nerve injuries related to carotid endarterectomy (CEA) surgery over the past 15 years in our academic center and to identify correlated risk factors.

Methods: From January 2007 to December 2022, a total of 3794 consecutive CEA procedures were performed and prospectively recorded in a dedicated database. Cranial nerve injuries were assessed and defined according to a standardized protocol. Preoperative specialized otolaryngologist evaluations were conducted within 30 days before intervention, whereas postoperative controls were performed before discharge. Preoperative neurological assessments were carried out in all patients with symptomatic carotid stenosis, whereas postoperative neurological evaluations were performed in all patients, regardless of lesion symptoms. Patients with newly onset cranial nerve injuries underwent follow-up assessments at 30 days and, if necessary, at 6 and 12 months. Perioperative results, including mortality, major central neurological events, and postoperative cranial nerve injuries, were analyzed.

Regression or persistence of lesions during follow-up visits was assessed, and multivariate analysis (binary logistic regression) was conducted to evaluate clinical, anatomical, and surgical technique factors influencing the occurrence of cranial nerve injuries.