The Radiographic Integrity of the Circle of Willis Predicts Early Cognitive Dysfunction After Carotid Endarterectomy

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Introduction

Subtle cognitive dysfunction occurs in approximately 25% of patients within 24 hours of carotid endarterectomy (CEA). One of the purported mechanisms of this early cognitive dysfunction (eCD) is global hypoperfusion due to inadequate collateral circulation during carotid artery cross clamping. We sought to determine whether poor collateral circulation within the circle of Willis (CoW), as determined by pre-operative computed tomography angiography (CTA) or magnetic resonance angiography (MRA), can predict eCD following CEA.

Methods

Patients who underwent CEA at a single institution between 2004 and 2012 and who had pre-operative MRA or CTA imaging were included in this study. Imaging was analyzed and patients were stratified according to posterior communicating (P.comm) artery status (radiographic visualization of =1 normal P.comm versus no normal P.comms). Univariate analyses (Chi-squared and Wilcoxon rank-sum) were performed using prospectively collected data for each patient, including pre-operative and post-operative neuropsychometric evaluation within 24 hours of CEA. Variables demonstrating a p-value <0.20 were included in a stepwise logistic regression model to identify predictors of eCD

Results

Forty-two CEA patients had pre-operative MRA or CTA imaging available for analysis. Four patients were excluded due to intra-operative EEG changes indicative of cerebral ischemia and subsequent carotid shunt placement. Variables included in the multivariate model of eCD were prior myocardial infarction (p=0.04), peripheral vascular disease (p=0.09), and radiographic absence of both P.comms (p=0.007). In the final multivariate logistic regression model, radiographic absence of both P.comms was the only significant predictor of eCD (OR: 0.104; 95% CI: 0.015 - 0.699; p=0.020).

Univariate Analyses

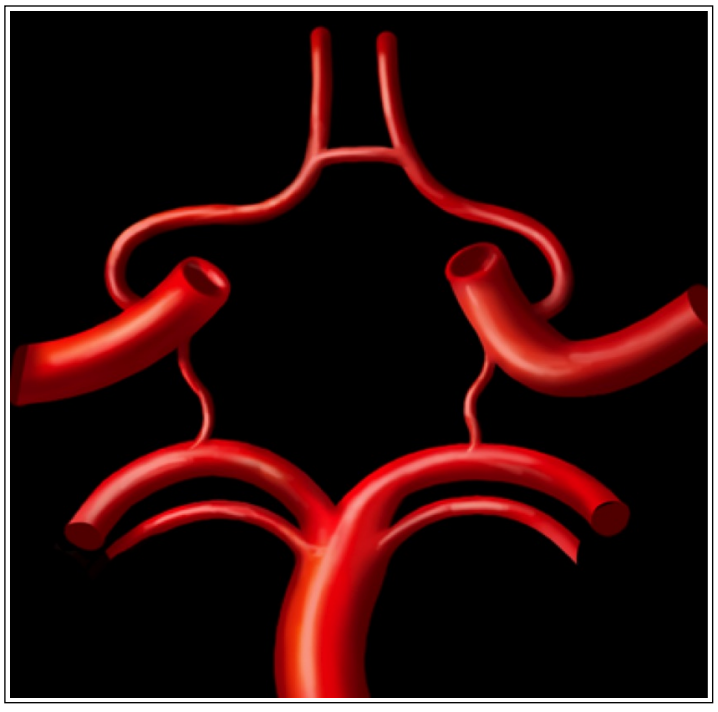
	ALL PATIENTS (N=38)	COGNITIVE DYSFUNCTION (N=9)	NO COGNITIVE DYSFUNCTION (N=29)	P-VALUE
Age > 75	34.20%	44.40%	31.00%	0.459
Sex, male	57.90%	66.70%	55.20%	0.542
Education, years	15.0 ± 2.9	14.8 ± 2.8	15.0 ± 3.0	0.822
BMI	25.0 ± 3.4	25.9 ± 3.7	24.8 ± 3.3	0.383
Smoking Hx	57.90%	66.70%	55.20%	0.542
ASA Use	73.70%	88.90%	69.00%	0.236
Statin Use	94.70%	88.90%	96.60%	0.369
Plavix Use	11.40%	0.00%	14.30%	0.288
DM	5.20%	0.00%	6.90%	0.418
HTN	57.90%	66.70%	55.20%	0.542
PVD	**23.70%**	**44.40%**	**17.20%**	**0.094**
Prior MI	**13.20%**	**33.30%**	**6.90%**	**0.04**
Symptomatic Status	60.50%	66.70%	58.60%	0.666
Cross-Clamp, mins	44.6 ± 11.6	43.4 ± 10.9	45.0 ± 11.9	0.737
Both P.Comms Abnormal	**39.50%**	**77.80%**	**27.60%**	**0.007**

Multivariate Analysis

	ODDS RATIO	95% CI	P-VALUE
PVD	2.613	0.154 - 44.221	0.5058
MI	2.726	0.101 - 73.893	0.5515
P.Comm Status	**0.104**	**0.015 - 0.699**	**0.0199**

Conclusions

Pre-operative identification of inadequate collateral circulation in the CoW may allow for prediction of patients who will experience eCD after CEA. Additional studies are necessary to further characterize the effect of CoW integrity on post-CEA eCD.



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