Risks and Causes of Non-Ipsilateral Stroke Complicating CEA

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Disclosures

- Member Clinical Events Committee – Bard Endovascular
- Consultant, CEC member – Medtronic
- Consultant - Endologix

Background

Stroke is a dreaded complication after CEA

Most studies use stroke and death in their primary outcome

Focus on Ipsilateral strokes

Contralateral strokes are rare but do occur

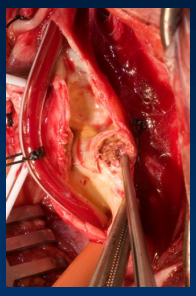
Background – CI Strokes

ACAS – 0.4%

NASCET – 0.3%

CREST – 0.6%

ICSS – 0.2%



Study Goal

Clarify the risk of peri-operative non-ipsilateral stroke after CEA

Define features predictive of contra-lateral stroke after CEA

Investigate the effect of laterality of post-op stroke on long-term survival

Contralateral Occlusion and Concomitant Procedures Drive Risk of Non-Ipsilateral Stroke After Carotid Endarterectomy

Methods - Patients

Review of the Vascular Quality Initiative (VQI) of the Society for Vascular Surgery

All CEA entered from 4/2003 – 3/2017

Exclusion

- patients who lacked laterality or stroke data
- Bilateral CEA within 30 days of index procedure

Methods - Endpoints

Primary endpoint – stroke within 30 days of indexed CEA

Stratified into ipsilateral or non-ipsilateral

Non-ipsilateral

- stroke in the cortical or ocular territory contra-lateral to CEA
- stroke in the vertebrobasilar territory

Methods - Variables

Concomitant Procedures:

- Carotid-subclavian bypass or transposition
- Carotid-carotid bypass
- Carotid-axillary bypass
- Prox endovascular intervention
- Carotid-cardiac surgery

Carotid stenosis categories

- < 50%
- 50-69%
- ≥ 70%

Results

80,230 CEA in 74,928 patients

Age	**70.3 years**
Male Gender	48,506 (60%)
Asymptomatic	43,074 (54%)
30-day Stroke	1469 (1.8%)
Ipsilateral Stroke	978 (1%)
Non-ipsilateral Stroke	491 (0.6%)
Hemispheric	334 (68%)
Ocular	44 (9%)
Vertebrobasilar	113 (23%)
Stroke within 6 hours	60%

Results - Demographics

Variable	No N-I stroke (n = 79739)	N-I stroke (n = 491)	p-value
Demographic			
Mean age ± SD, years	70.3 ± 9	70.5 ± 10	.461
Male	48208 (6)	298 (61)	.916
Caucasian	73520 (92)	447 (91)	.302
Ever smoker	60175 (76)	368 (75)	.791
Hypertension	70708 (89)	448 (91)	.064
Diabetes mellitus	27951 (35)	175 (36)	.779
CAD	21585 (27)	131 (27)	.992
CHF	8194 (10)	39 (8)	.093
COPD	17717 (22)	114 (23)	.595
CRF	1025 (1)	5 (1)	.602
Stress test performance	6458 (24)	36 (22)	.514
Preoperative facility placement[a]	986 (1.24)	11 (2.25)	.045
Creatinin ≥ 1.5 mg/dL	11689 (15)	66 (13)	.447

Results - Anatomic

Variable	No N-I stroke (n = 79739)	N-I stroke (n = 491)	p-value
Anatomical and diagnostic features			
Symptomatic stenosis	36844 (46)	312 (64)	<.001
Prior ipsilateral CEA/CAS[b]	1757 (2)	18 (4)	.028
Prior contralateral CEA	10672 (13)	65 (13)	.925
Prior contralateral CAS	567 (0.7)	5 (1)	.420
Any prior CEA/CAS	12996 (16)	88 (18)	.387
Radiation	1080 (1.36)	12 (2.45)	.038
Anatomical high risk features	3030 (5)	21 (6)	.478

Results - Diagnostic

Variable	No N-I stroke (n = 79739)	N-I stroke (n = 491)	p-value
Ipsilateral carotid stenosis grade			.084
<50%	1720 (3)	12 (4)	
50–69%	7047 (14)	53 (18)	
≥70%	42130 (83)	229 (78)	
Contralateral carotid stenosis grade			.001
<50%	26381 (57)	125 (50)	
50–69%	12032 (26)	58 (23)	
≥70%	7967 (17)	66 (27)	
Contralateral carotid occlusion	2210 (3)	29 (6)	.001
Pre-operative duplex ultrasound	66236 (84)	402 (82)	.387
Duplex ultrasound only	26536 (33)	147 (30)	.117
Pre-operative CTA	39588 (50)	267 (55)	.043
Pre-operative MRA	12581 (16)	91 (19)	.104
Pre-operative arteriogram	5657 (7)	32 (7)	.621

Results – Medical Therapy

Variable	No N-I stroke (n = 79739)	N-I stroke (n = 491)	p-value
Medical therapy			
Beta blocker	47540 (60)	293 (60)	.978
Aspirin	66050 (83)	406 (83)	.955
P2Y inhibitors	23206 (29)	141 (28)	.855
Dual antiplatelet therapy	18996 (24)	115 (23)	.835
Pre-operative anti-angiotensin	33514 (52)	172 (45)	.006
Statin	63812 (80)	372 (76)	.020

Results – Operative Factors

Variable	No N-I stroke (n = 79739)	N-I stroke (n = 491)	p-value
Operative factors			
Mean length of operation ± SD, min	118.8 ± 51	142.5 ± 77	<.001
Urgent operation	10090 (13)	121 (21)	<.001
CEA with cardiac surgery	1408 (2)	25 (5)	<.001
CEA with other arterial surgery	885 (1)	12 (2)	.005
Ipsilateral proximal hybrid endovascular procedure	510 (1)	14 (3)	<.005
Shunt	42988 (54)	296 (61)	.005
Dextran	8318 (10)	31 (6)	.003
Protamine	52126 (66)	302 (62)	.078
Eversion technique (versus longitudinal)	10010 (13)	69 (14)	.293
Type of anaesthesia			.511
local	1254 (2)	6 (1)	
regional	5620 (7)	29 (6)	
general	72711 (91)	453 (93)	
EEG monitoring	22752 (29)	146 (20)	.533
Stump pressure use	7504 (9)	39 (8)	.272

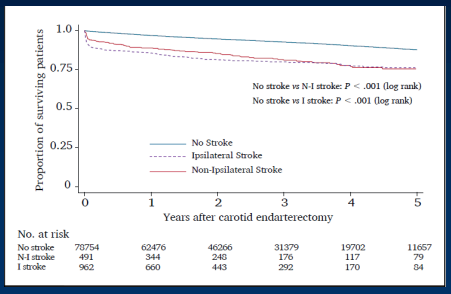
Results – Post-op Factors

Variable	No N-I stroke (n = 79739)	N-I stroke (n = 491)	p-value
Post-operative factors			
Dysrhythmia	1453 (2)	33 (7)	<.001
Hypotension requiring IV treatment	8182 (10)	110 (22)	<.001
Hypertension requiring IV treatment	13745 (17)	136 (28)	<.001
Myocardial infarction	638 (1)	17 (3)	<.001
Reperfusion syndrome	127 (0.2)	7 (1)	<.001
Re-exploration of neck	1326 (2)	40 (8)	<.001

Results – Multivariate Predictors

Predictor	Non-ipsilateral stroke	
	OR (95% CI)	p-value
Pre-operative factors		
Contralateral occlusion	1.9 (1.3–2.8)	.001
Symptomatic	1.7 (1.3–2.1)	<.001
Urgency	1.5 (1.2–1.9)	.001
Pre-operative anti-angiotensin	0.8 (0.6–0.97)	.027
Peri-operative factors		
CEA/proximal intervention	2.6 (1.3–5.4)	.010
CEA with cardiac surgery	1.9 (1.1–3.1)	.013
Shunt	1.3 (1.0–1.7)	.008
Dextran	0.6 (0.4–0.9)	.011
Post-operative factors		
Reperfusion	6.3 (2.8–14.1)	<.001
Re-exploration of neck	5.6 (3.9–8.1)	<.001
IV treatment for hypotension	2.5 (2.0–3.3)	<.001
Myocardial infarction	2.0 (1.4–2.7)	<.001
IV treatment for hypertension	1.8 (1.5–2.3)	<.001

Results – Long-term Survival



Conclusion

- Non-ipsilateral stroke after CEA is rare
- Driven by:
  - Global disease burden
  - Combined procedures
  - Hemodynamic Fluctuations
- Contralateral occlusion independently increases risk of non-ipsilateral stroke
- Patients with stroke after CEA have a lower long-term survival than those without regardless of laterality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