Tandem Carotid Bifurcation and Sup Aortic Trunk Lesions: Optimal Treatment by Symptomatic Status and Controversies

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1

No Disclosures

- Discuss tandem lesion management by symptomatic status
- Discuss hybrid sequencing controversy

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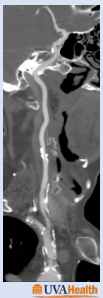
Tandem Lesions

Optimal management unclear

- Anatomic transthoracic + CEA } *OPEN*
- Extra-anatomic + CEA
- Total *ENDO*
- *HYBRID*
  - CEA + Ipsi Prox Endo Intervention (CEA+IPE)
    - Open Retrograde
    - Transfemoral with ICA XC
  - Open exposure with reversal of flow
- *STAGED*



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Tandem Lesions

We do not know:

- Natural Hx of Tandem Lesions or SAT disease
- Treatment outcomes with staged

Summary and recommendations.

1. Interventions (open or endovascular) to treat proximal CCA or innominate artery critical lesions are not suggested in asymptomatic patients.
2. In symptomatic patients, the choice of open (cervical vs transthoracic), hybrid, or endovascular treatment is dependent on patient anatomy and comorbidities. Embolic protection is suggested for endovascular intervention if feasible.

Recommendation 123 — Unchanged

For asymptomatic patients with proximal common carotid artery or innominate artery stenoses/occlusions, open or endovascular interventions are not recommended.

Class	Level	References
III	C	Consensus

Recommendation 124 — Unchanged

For symptomatic patients with proximal common carotid artery or innominate stenoses, open retrograde angioplasty and stenting should be considered.

Class	Level	References	ToE
IIa	C	Robertson *et al.* (2020)[66], Van de Weijer *et al.* (2015)[67]	

4

Why Treat with Hybrid CEA + IPE

- Described in 1996 by Diethrich
- Avoids arch disease & tortuosity
- Short, direct arch lesion access
- Carotid clamp neuroprotection
- Simplifies BC revascularization
- Reduced incisional morbidity
- Less anesthesia time
- Allows later open/hybrid/endo
- Reduced stroke/death-risk??

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CEA + IPE

From the Society for Vascular Surgery

Risk and outcome profile of carotid endarterectomy with proximal intervention is concerning in multi-institutional assessment

W. Darrin Clouse, MD,[a] Emel A. Ergul, MS,[a] Zachary J. Wanken, MD,[b] Julia Keene, MD,[c] David H. Stone, MD,[a] R. Clement Darling III, MD,[c] Richard P. Cambria, MD,[a] and Mark F. Conrad, MD, MMSc,[a] Boston, Mass; Lebanon, NH; and Albany, NY

J Vasc Surg 2018;68:760-9

30-day Stroke		6	(9.7%)
Ipsilateral		4	(6.5%)
Reperfusion		2	(3.2%)
30-day Death		3	(4.8%)
Cardiac	2	(3.2%)	
Stroke		1	(1.6%)

30-day Neurologic Event & Death
Across Centers: 13.3%, 11.5%, 9.5% (p=0.13) *Combined: 7 (11.3%)*

5-year freedom from restenosis: 66%
freedom from re-intervention: 81%

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Editors' Choice

From the Vascular and Endovascular Surgery Society

Addition of proximal intervention to carotid endarterectomy increases risk of stroke and death

Linda J. Wang, MD, MBA,[a] Emel A. Ergul, MA,[a] Mark F. Conrad, MD, MMSc,[a] Mahmoud B. Malas, MD, MS,[b] Vikram S. Kashyap, MD,[c] Philip P. Goodney, MD, MS,[d] Virendra I. Patel, MD, MPH,[a] and W. Darrin Clouse, MD,[a] *Boston, Mass; Baltimore, Md; Cleveland, Ohio; Lebanon, NH; and New York, NY*

J Vasc Surg 2019;69:1102-10

30-Day outcomes	Total cohort (N = 66,519), No. (%) ICEA (n = 66,115)	Total cohort (N = 66,519), No. (%) CEA ± IPE (n = 404)	P	Asymptomatic patients (n = 39,402), No. (%) ICEA (n = 39,181)	Asymptomatic patients (n = 39,402), No. (%) CEA ± IPE (n = 221)	P	Symptomatic patients (n = 27,049), No. (%) ICEA (n = 26,867)	Symptomatic patients (n = 27,049), No. (%) CEA ± IPE (n = 182)	P
Stroke	927 (1.4)	12 (3.0)	.01	422 (1.1)	3 (1.4)	.52	504 (1.9)	9 (4.9)	.002
Death	360 (0.5)	4 (1.0)	.23	171 (0.4)	0 (0)	.33	189 (0.7)	4 (2.2)	.04
Combined stroke/death	1219 (1.8)	14 (3.5)	.02	566 (1.4)	3 (1.4)	.91	652 (2.4)	11 (6.0)	.002

S/D

Risk factor	OR	95% CI	P
Diabetes	1.2	1.1-1.4	.001
CAD	1.2	1.1-1.4	.01
Symptomatic	1.7	1.5-1.9	<.001
CEA ± IPE	1.9	1.3-3.4	.02

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Tandem Lesions: Open SAT Reconstruction + CEA

Impact of Adding Carotid Endarterectomy to Supra-aortic Trunk Surgical Reconstruction

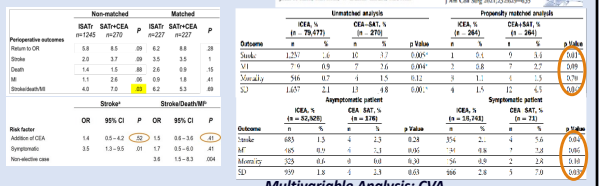
Linda J. Wang,[a] Sarah C. Crofts,[a] Thomas P. Nixon,[a] Bernadette J. Goudreau,[a] David L. Chung,[a] Mark F. Conrad,[a] Matthew J. Eagleton,[a] and W. Darrin Clouse,[a] *Boston, Massachusetts, and Charlottesville, Virginia*

Ann Vasc Surg 2020; 69: 27–33

Adding Supra-Aortic Trunk Surgical Reconstruction to Carotid Endarterectomy: Implications on Risk of Stroke and Death

Bernadette J Goudreau, MD, MMSc, Linda J Wang, MD, MBA, Christopher A Lutz, MD, MPH, Mark F Conrad, MD, MMSc, FACS, Carlos A Williams, MD, FACS, Margaret C Tracci, MD, PhD, FACS, John A Kern, MD, FACS, W Darrin Clouse, MD, FACS

J Am Coll Surg 2021;233:629–635



Multivariable Analysis: CVA

CEA+SAT OR 2.72 (1.1-6.8), p=.03

Symptomatic Status OR 1.4 (1.0-2.0); p=.05

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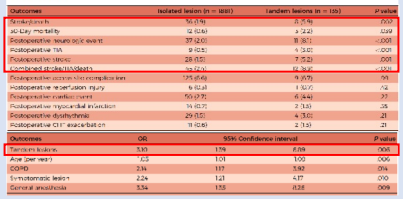
Tandem Lesions: Total Percutaneous Approach

VQI 2005-2020

Simultaneous treatment of common carotid lesions increases the risk of stroke and death after carotid artery stenting

Charles DeCarlo, MD,[a] Adam Tanious, MD, MMSc,[a] Laura T. Boitano, MD, MPH,[a] Jahan Mohebali, MD,[a] David H. Stone, MD,[b] W. Darrin Clouse, MD,[a] and Mark F. Conrad, MD, MMSc,[a] *Boston, Mass; Lebanon, NH; and Charlottesville, VA*

J Vasc Surg 2021;74:592-8



S/D

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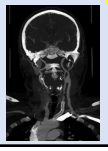
Comparison of 30 Day Stroke and Death in Hybrid Intervention and Open Surgical Reconstruction for the Treatment of Tandem Carotid Bifurcation and Supra-aortic Trunk Disease☆

Linda J. Wang [a], Thomas P. Nixon [a], Sarah C. Crofts [a], Christopher A. Lutz [a], Bernadette J. Goudreau [b], Mark F. Conrad [a], Matthew J. Eagleton [a], W. Darrin Clouse [b,*]

Eur J Vasc Endovasc Surg (2021) 61, 83–88

2005-2017 NSQIP	Total Cohort N=372	CEA+SAT n=319	CEA+IPE n=53	P
Operative characteristics				
Elective	194 (83%)	170 (83%)	24 (80%)	.65
Operative time, hours	3.1 (2.4-4.0)	3.1 (2.4-4.0)	2.9 (2.1-3.6)	.02
Reconstruction				
Aorta to great vessel bypass		22 (7%)		
Carotid-carotid bypass		96 (30%)		
Carotid-subclavian bypass		179 (56%)		
Carotid-subclavian transp.		22 (7%)		



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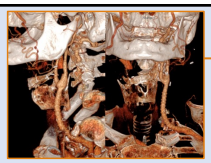
10



30-Day Outcomes

	Total Cohort N=372	CEA+SAT n=319	CEA+IPE n=53	P
Operative Outcomes				
Return to OR	29 (7.8%)	25 (7.8%)	4 (7.5%)	.94
Stroke	15 (4.0%)	13 (4.1%)	2 (3.8%)	.92
Death	5 (1.3%)	5 (1.6%)	0 (0.0%)	.36
MI	8 (2.2%)	8 (2.5%)	0 (0.0%)	.24
Stroke/death	19 (5.1%)	17 (5.3%)	2 (3.8%)	.63

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Predictors of Stroke and Death

Risk Factor	Odds Ratio	95% Confidence Interval	P
IPE (vs SAT)	0.6	0.1-5.0	.63
Functional independence preop	0.9	0.1-8.7	.91
Congestive heart failure	16.5	2.0-136.2	.01
Return to OR	8.5	2.3-30.8	.001
Symptomatic	3.9	1.1-13.5	.03

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12

Tandem Lesions: Total Percutaneous Approach

VQI 2005-2020

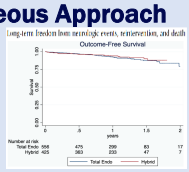
Hybrid and Total Endovascular Approaches to Tandem Carotid Artery Lesions Have Similar Short- and Long-Term Outcomes

Ann Vasc Surg 2021; 76: 20–27

Charles DeCarlo,[1] Adam Tanious,[1] Laura T. Boitano,[1] Jahan Mohebali,[1] David H. Stone,[2] W. Darrin Clouse,[3] and Mark K. Conrad[1]

	Endovascular	Hybrid	P-value
	N=795	N=638	
Stroke/Death	31 (3.9%)	23 (3.6%)	0.77
	36 (4.5%)	30 (4.7%)	0.88
Stroke/Death/MI			
Stroke	24 (3.0%)	16 (2.5%)	0.56
30-Day Mortality	9 (1.1%)	10 (1.6%)	0.47
MI	9 (1.1%)	13 (2.0%)	0.17

S/D	Odds Ratio	95% CI		P-value
Hybrid approach	1.29	0.55	3.07	0.56
Insurance: Medicare	3.06	1.44	6.47	0.003
ESRD on HD	16.0	2.38	107.8	0.004
Symptomatic Status	0.85	0.36	1.98	0.70
ICA stenosis>70%	0.80	0.23	2.81	0.73



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13

Tandem Lesions: Restructured Meta-Analysis

A systematic review and meta-analysis of combined carotid endarterectomy with ipsilateral proximal intervention (hybrid approach) for tandem carotid artery lesions

Wanting Qi, MD, Zhichao Lai, MD, Jiang Shao, MD, Kang Li, MD, Lijing Fang, MD, Leyin Xu, MD, Xin Zhang, MD, and Bao Liu, MD, *Beijing, China*

J Vasc Surg 2021;73:2168-77

275 CEA + IPE Patients; 67% Symptomatic

3.3% 30-d S/D

IPE First-Significantly Less Stroke (0% vs 5.7%; p=.01)

6.6% Re-intervention

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Tandem Lesions CEA + IPE: Symptom Status

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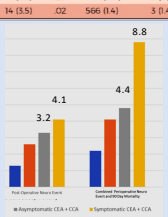

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Tandem Lesion Treatment by Symptom Status

		CEA+IPE	Total Open	Total Endo
Asymptomatic	Stroke	1.4 -4.1%	2.0-4.0%	4.0%
	S/D	1.4-4.0%	2.3-4.5%	4.7%
Symptomatic	Stroke	4.1-5.1%	2.8-5.6%	4.2%
	S/D	6.0-8.0%	5.3-7.6%	5.0%

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16

Tandem CEA + SAT Lesion Treatment

- Approach Asymptomatic CAUTIOUSLY!
- Beware long-segment CCA Disease
- Good open surgery is a GREAT solution
- If Duplex & carotid pulse are good- *DON'T*
- Worry about HYBRID CEA+IPE restenosis
- Staging may be a good option??
- DAPT
- Do NOT move the carotid clamp
- *No difference in MACE by reconstruction type: OPEN/ENDO/HYBRID options*

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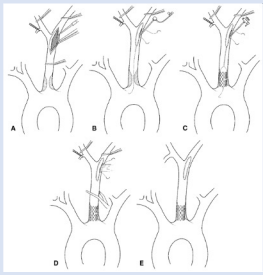
17

CEA First



- *Disadvantages:*
  - Possible thrombus formation at CEA zone
  - Time spent in CEA should proximal complication occur
  - Manipulation of CEA/CCA endpoint
  - Proper Flushing Maneuvers
  - Shunting with inflow disease
- *Advantage:*
  - Disease free area of access
  - Rapid flow restoration after stenting

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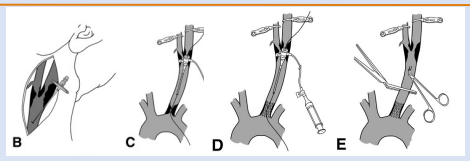
18

IPE First



- *Disadvantage:*
  - Possible thrombus formation at TBA/Stent zone
  - Complicates shunt placement
  - Neuro changes with clamping
- *Advantage:*
  - No alterations to CEA conduct
  - Maintain bifurcation flow if CCA accessed
  - Wide standard flushing at CEA completion

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19

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20