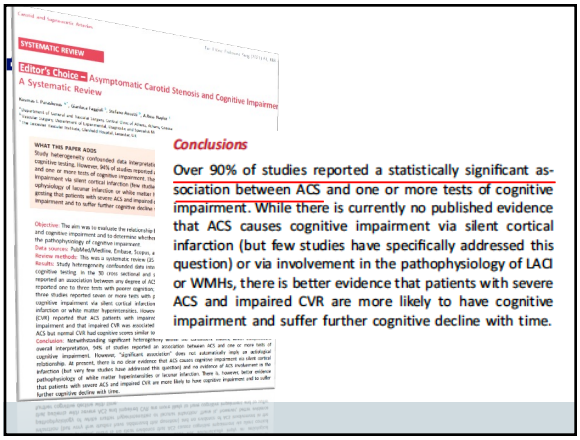
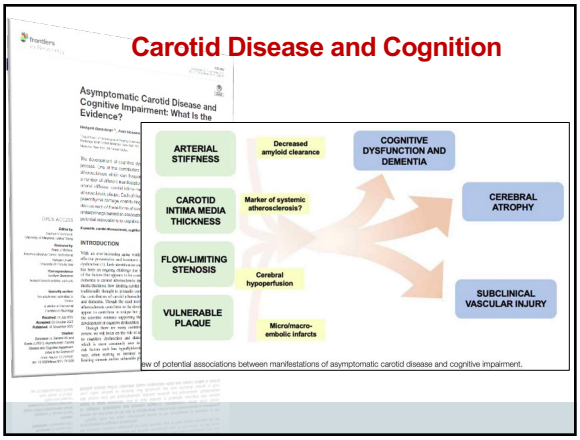
Carotid Intervention Improves Cognitive Function Of Patients With Severe Carotid Atherosclerosis: What About In Octogenarians: Should More Or Fewer ACS Patients Undergo Invasive Treatment

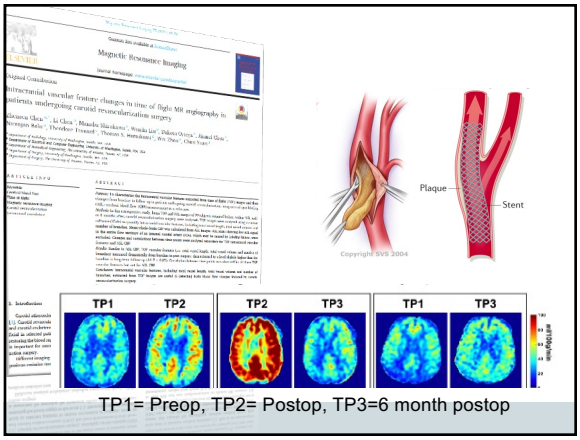
Wei Zhou, MD
Chief, Division of Vascular Surgery
Professor of Surgery, University of Arizona
THE UNIVERSITY OF ARIZONA



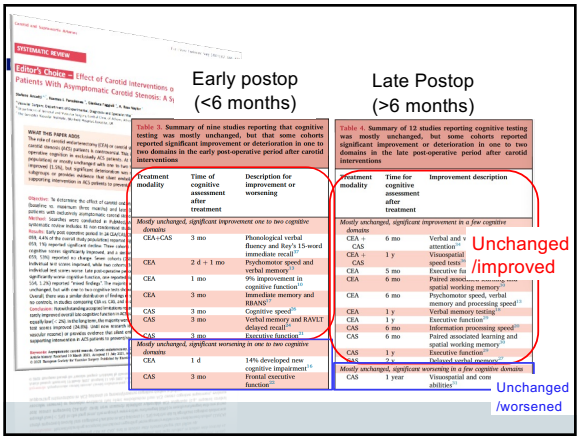
Carotid Disease and Cognition



ew of potential associations between manifestations of asymptomatic carotid disease and cognitive impairment.



TP1= Preop, TP2= Postop, TP3=6 month postop



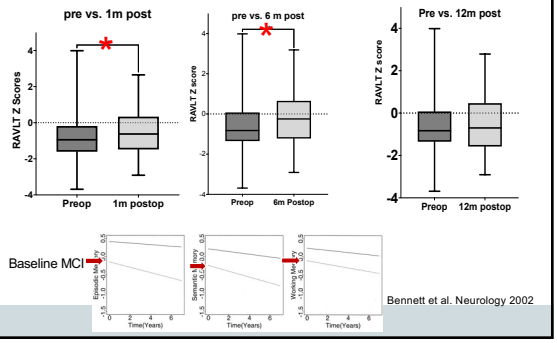
Evaluate Cognitive Impact of Carotid Intervention

- NIH-sponsored clinical study (ZhouR01 NS070308)
  - 170 prospectively recruited patients
  - Cognitive and MRI evaluations
- Longitudinal cognitive follow-up
  - Preop, 1, 6, and 12 months postop
  - MMSE
  - **Episodic Memory** – RAVLT with parallel forms
  - **Executive function** – Multiple cognitive measures: WAISEIII-digit spin, Letter/number, TMT-A, TMT-B,

Overall Episodic Memory

RAVLTsum Z-score

Normalized with age and education-matched controls



Bennett et al. Neurology 2002

Overall Cognitive Function

Carotid Intervention Improves Cognitive Function with Severe Atherosclerotic Carotid Disease

	n	Preop Mean±SD(CI)	Postop Mean ±SD(CI)	P-value	Cohen's d
Preop vs. 1 month postop					
WAISE III-Digit Span	133	10.38 ± 2.76 (9.9-10.85)	10.65 ± 2.72 (10.18-11.11)	*0.077*	0.154
WAISEIII-Letter/Number	104	8.45 ± 3.44(7.78-9.12)	9.09 ± 3.06(8.49-9.68)	***0.016***	0.240
TMT - A	132	7.74 ± 3.09(7.21-8.27)	8.41 ± 3.20(7.86-8.96)	***<0.001***	0.313
TMT- B	126	7.92 ± 3.06(7.38-8.46)	8.54 ± 3.04(8-9.08)	***0.003***	0.273
BNT	120	10.78 ± 2.75(10.28-11.27)	10.28 ± 2.86(9.77-10.80)	***0.001***	0.312
GDS	127	7.51 ± 6.12(6.44-8.59)	6.72 ± 6.13(5.65-7.80)	***0.015***	0.220
Preop vs. 6 months postop					
Digit Span	99	10.54 ± 3.02(9.93-11.14)	11.12 ± 2.81(10.56-11.68)	***0.011***	0.261
Letter/number	83	8.92 ± 3.29(8.20-9.64)	9.59 ± 3.00(8.94-10.25)	***0.028***	0.245
TMT - A	98	8.07 ± 3.33(7.40-8.74)	8.94 ± 3.40(8.26-9.62)	***0.001***	0.341
TMT- B	97	8.12 ± 3.10(7.50-8.75)	8.86 ± 2.90(8.27-9.44)	***0.005***	0.291
BNT	92	10.22 ± 3.14(9.57-10.87)	10.95 ± 3.06(10.31-11.58)	***<0.001***	0.410
GDS	97	7.42 ± 6.20(6.17-8.67)	7.24 ± 6.41(5.94-8.53)	*0.656*	0.045
Preop vs. 12 months postop					
Digit Span	87	10.37 ± 2.76(9.78-10.96)	11.05 ± 2.90(10.43-11.67)	***0.002***	0.345
Letter/number	63	8.52 ± 3.47(7.65-9.40)	9.37 ± 3.66(8.44-10.29)	***0.043***	0.260
TMT - A	81	7.79 ± 3.02(7.12-8.46)	9.07 ± 3.48(8.30-9.85)	***<0.001***	***0.576***
TMT- B	80	7.93 ± 3.06(7.24-8.61)	8.68 ± 3.37(7.92-9.43)	***0.016***	0.276
BNT	78	10.45 ± 2.97(9.78-11.12)	11.26 ± 2.66(10.66-11.86)	***<0.001***	0.436
GDS	82	7.73 ± 5.81(6.45-9.01)	6.84 ± 6.14(5.49-8.19)	*0.087*	0.191

Octogenarians

Cognitive effects of carotid revascularization in octogenarians

Characteristics	No. (%)	N=170	Age ≥ 80 N= 23 (13)	Age<80 N= 147 (87)	P-value
Age, years, mean ± SD		69.72 ±7.741	84.13 ± 2.95	67.46 ± 5.49	**<0.001**
CAS (vs CEA)		87(51.2)	14(60.8)	73(50)	0.332
Prior stroke		32(18.82)	5(21.7)	27(18.37)	0.774
Diabetes		70(41.2)	6(26)	64(43.5)	0.113
Smoking		*113(79)*	14(61)	119(81)	***0.030***
Alcohol		*86(51.6)*	8(34.8)	78(53)	*0.103*
Hypertension		147(86.5)	23(100)	124(84)	**0.046**
Hyperlipidemia		145(85.3)	21(91.3)	124(84.3)	0.534
Obesity		59(34.7)	3(13)	56(38)	**0.018**
Coronary Artery Disease		*74(43.6)*	16(69)	58(39)	**0.006**
Congestive Heart Failure		20(11.8)	4(17.4)	16(10.8)	0.482
COPD		25(14.7)	5(21.7)	20(13.6)	0.341
Peripheral Vascular Disease		38(22.4)	2(8.7)	36(24.5)	0.090
Atrial Fibrillation		21(12.4)	7(30)	14(9)	**0.011**
Chronic Renal Failure		34(20)	6(26)	28(19)	0.411
Medication					
Antiplatelets		119(70)	17(73.9)	102(69.4)	0.659
Anticoagulants		34(20)	7(30.4)	27(18.4)	0.259
Statins		152(89.4)	21(91.3)	131(89)	1.000
Symptomatic		87(51.2)	11(47.8)	76(51.7)	0.729

Memory in Octogenarians

Cognitive effects of carotid revascularization in octogenarians

Table 2-Median RAVLT sum Z score by timepoints in octogenarians

	Octogenarians
Timepoint	**Median [IQR]**
Pre-op(n=23)	-0.84[-2.29, 1.61]
Post-op(n=16)	-1.09[-2.67, 1.31]
6 months(n=11)	-1.04[-2.06, 0.08]
12 months(n=9)	-0.72[-1.75, 1.81]
Pre-op vs. Post-op (n=16) *	-0.93[-1.96, 1] vs. -1.09[-2.67, 1.31]; p=0.247
Pre-op vs. 6 months (n=11) *	-0.62[-1.75, 0.55] vs. -1.04[-2.06, 0.08]; p=0.152
Pre-op vs. 12 months (n=9) *	-0.83[-1.75, 1] vs. -0.72[-1.75, 1.81]; p=0.844

P-value reported from Wilcoxon signed-rank test

- No significant change signal in octogenarians

Executive Function in Octogenarians

Cognitive effects of carotid revascularization in octogenarians

Table 3- Comparison of age and education adjusted scaled scores in patients < 80 years and seniors ≥ 80 years

		Non-Octogenarian (<80) (n=147)				Octogenarian (≥ 80) (n=23)			
Time points	Cognitive measures	n	Mean difference ±SE	95% CI	p*	n	Mean difference ±SE	95% CI	p**
1 month Postop vs. Preop (Ref)	Digit Span	119	0.39 ±0.16	(0.07 ; 0.16)	**0.015**	13	-0.69 ±0.41	(-1.59 ; 0.21)	0.168
	Digit Symbol	113	0.41 ±0.13	(0.15 ; 0.68)	**0.002**	14	0.5 ±0.34	(-0.24 ; 1.24)	0.265
	Letter/Number	96	0.65 ±0.27	(0.12 ; 1.19)	**0.016**	8	0.37 ±1.05	(-2.11 ; 2.86)	1.000
	TMT-A	117	0.64 ±0.19	(0.25 ; 1.02)	**0.001**	15	0.87 ±0.61	(-0.45 ; 2.18)	0.150
	TMT-B	112	0.79 ±0.18	(0.42 ; 1.16)	**<0.001**	14	-0.78 ±0.98	(-2.91 ; 1.34)	0.813
	BNT	109	0.55 ±0.15	(0.24 ; 0.85)	**<0.001**	10	-0.1 ±0.40	(-1.02 ; 0.82)	0.906
6 months Postop vs. Preop (Ref)	Digit Span	89	0.6 ±0.24	(0.16 ; 1.11)	**0.009**	10	0.1 ±0.67	(-1.42 ; 1.62)	1.00
	Digit Symbol	84	0.45 ±0.17	(0.10 ; 0.80)	**0.011**	10	0.3 ±0.66	(-1.21 ; 1.81)	0.835
	Letter/Number	76	0.75 ±0.31	(0.12 ; 1.37)	**0.019**	7	-0.14 ±1.14	(-2.93 ; 2.65)	0.859
	TMT-A	87	0.91 ±0.27	(0.36 ; 1.45)	**0.001**	11	0.54 ±0.74	(-1.11 ; 2.21)	0.57
	TMT-B	86	0.89 ±0.27	(0.36 ; 1.43)	**0.001**	11	-0.54 ±0.68	(-2.06 ; 0.97)	0.457
	BNT	86	0.71 ±0.19	(0.32 ; 1.09)	**<0.001**	6	1 ±0.63	(-0.62 ; 2.62)	0.250
12 months Postop vs. Preop (Ref)	Digit Span	77	0.71 ±0.21	(0.29 ; 1.13)	**0.001**	9	0.55 ±0.98	(-1.72 ; 2.83)	0.672
	Digit Symbol	71	0.67 ±0.18	(0.31 ; 1.03)	**<0.001**	9	0.33 ±0.64	(-1.15 ; 1.82)	0.652
	Letter/Number	58	0.79 ±0.44	(-0.08 ; 1.67)	0.075	5	1.4 ±0.81	(-0.85 ; 3.65)	0.250
	TMT-A	73	1.30 ±0.26	(0.77 ; 1.83)	**<0.001**	8	1.12 ±0.66	(-0.45 ; 2.70)	0.187
	TMT-B	72	1.08 ±0.28	(0.51 ; 1.65)	**<0.001**	8	-2.25 ±1.23	(-5.17 ; 0.67)	0.125
	BNT	72	0.83 ±0.22	(0.38 ; 1.28)	**<0.001**	5	0.6 ±0.51	(-0.81 ; 2.01)	0.500

CI : Confidence Interval SE : Standard Error

Preoperative scores were the reference for comparison at each postoperative time point

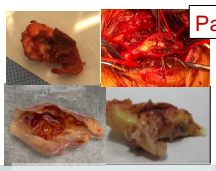
* P-value reported from Paired t-test

** P-value reported from Wilcoxon signed-rank test

Should More Or Fewer ACS Patients Undergo Invasive Treatment

- Carotid intervention has an overall positive impact on cognitive function for patients with severe carotid atherosclerosis
- The cognitive benefit was not observed in octogenarians

Patient-Targeted Therapy



Symptomatic lesions

Asymptomatic lesion