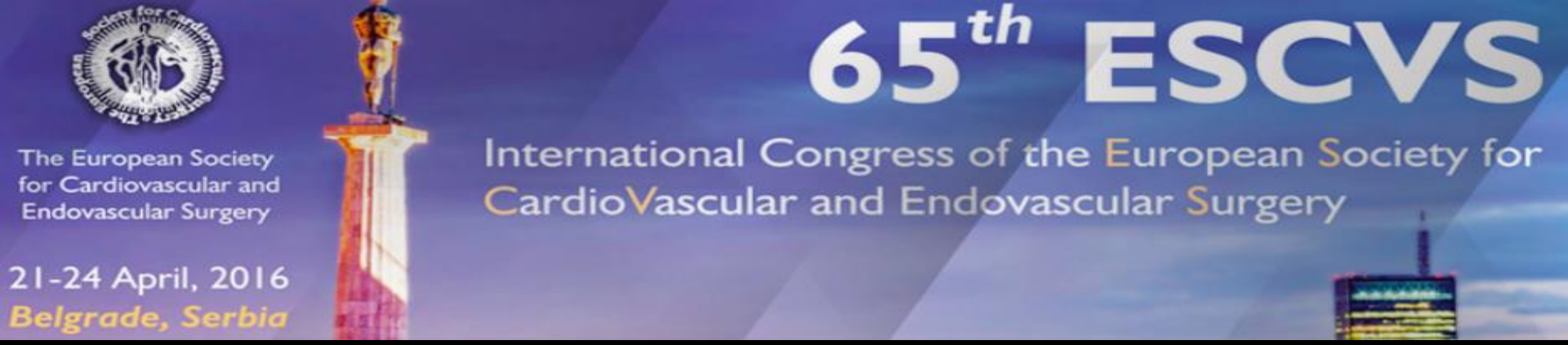


Can carotid intervention prevent dementia?

Athanasios Giannoukas, MSc, MD, PhD, FEBVS

Professor of Vascular Surgery,

Faculty of Medicine, School of Health Sciences, University of Thessaly

Chairman, Department of Vascular Surgery, University Hospital of Larissa, Greece

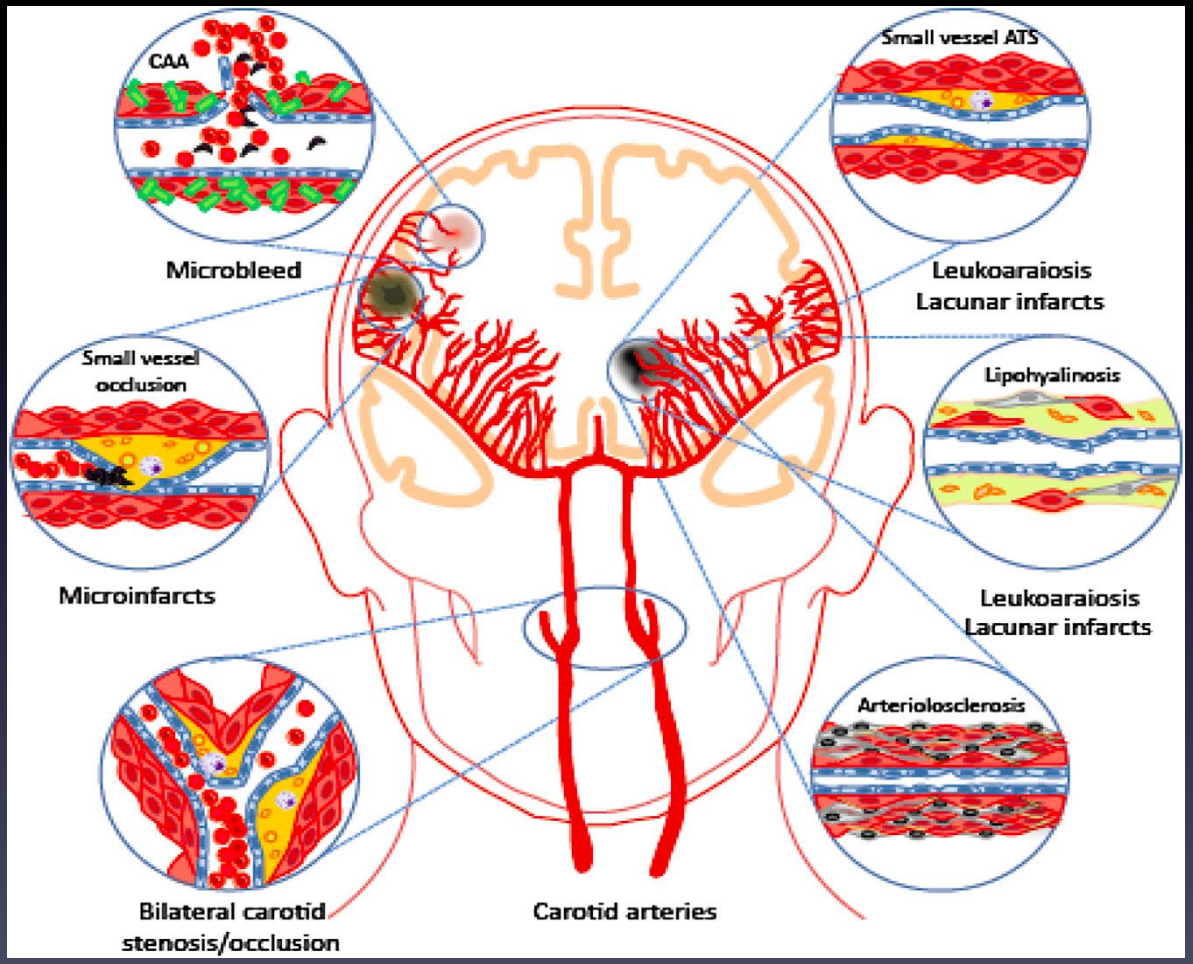
What is dementia?

- A decline in cognition involving one or more cognitive domains (learning and memory, language, executive function, complex attention, perceptual-motor, social cognition)

- The deficits must represent a decline from previous level of function and be severe enough to interfere with daily function and independence

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), 2013

Vascular lesions and Dementia



Iadecola et al, Neuron 2013 Nov 20;80(4):844-66

Carotid disease and cognitive function

Cognitive Impairment and Decline Are Associated with Carotid Artery Disease in Patients without Clinically Evident Cerebrovascular Disease

S. Claiborne Johnston, MD, PhD; Ellen S. O'Meara, PhD; Teri A. Manolio, MD, PhD; David Lefkowitz, MD; Daniel H. O'Leary, MD; Steven Goldstein, MD†; Michelle C. Carlson, PhD; Linda P. Fried, MD, MPH; and W.T. Longstreth Jr., MD, MPH

Decline of modified mini-Mental examination with LT ICA stenosis >75%)

Total cerebral blood flow in relation to cognitive function: The Rotterdam Scan Study

Mariëlle MF Poels[1,2], Mohammad Arfan Ikram[1], Meike W Vernooij[1,2], Gabriel P Krestin[2], Albert Hofman[1], Wiro J Niessen[2,3], Aad van der Lugt[2] and Monique MB Breteler[1]

TCBF on MRI was associated with worse information – processing speed, executive function and global cognition. However after correcting TCBF for brain volume these associations disappeared

Johnston et al, Ann Intern Med 2004
Poels et al, J Cereb Blood Flow Metab 2008

CIMT and cognitive function

8208 participants / mean CIMT 0.73 ± 0.16 mm

	Multiple regression model[a]	p
Delayed word recall test	−0.433 (−0.724; −0.142)	0.004
Category fluency test	0.219 (−0.555; 0.992)	0.56
Trail making test	3.41 (−7.88; 14.71)	0.55

- ✓ Increase in CIMT was associated with worse performance on DWRT
- ✓ Worse performance in TMT with greater CIMT and current alcohol use

Suemoto et al, Atherosclerosis 2015

Asymptomatic Carotid Stenosis and cognitive function

- ✓ Patients with B-ACS and unilateral ACS showed significantly lower scores in all cognitive tests (phenomenic and categorical Verbal Fluency tests for the LT Brain - Colored progressive matrices and Complex figure copy tests for the RT Brain) compared to those with no carotid stenosis

- ✓ B-ACS with LT impaired hemodynamic status (on TCD-based breath-holding index test) showed reduced phenomenic and categorical Verbal Fluency tests for the LT Brain compared to those with no carotid stenosis

- ✓ B-ACS with RT impaired hemodynamic status (on TCD-based breath-holding index test) showed reduced Colored progressive matrices and Complex figure copy tests for the RT Brain compared to those with no carotid stenosis

Balucani et al, Neurology 2012

What are the causes?

- ✓ Haemodynamic changes because of severe carotid stenosis, embolisation from carotid plaque or both?
- ✓ Arguably by restoration of normal blood flow to the brain it will regain its normal function.

Carotid intervention and cognitive function

- ✓ early performance of carotid intervention in suitable asymptomatic patients may reduce the incidence of associated cognitive dysfunction

Conflicting results

Cognitive improvement after CEA

Tests of reaction time (ms)	Preoperative	Five days postop	*P* value	Eight weeks postop	*P* value
Simple	294 (257–357)	319 (269–378)	0.001	303 (270–353)	NS
Choice	508 (462–557)	499 (459–561)	NS	490 (459–551)	NS
Number vigilance	448 (413–496)	455 (413–496)	NS	446 (412–487)	NS
Memory	1049 (893–1353)	1005 (827–1229)	0.0001	993 (823–1214)	0.001
Word recognition	1140 (969–1447)	1074 (904–1367)	0.001	1048 (880–1284)	0.0001
Picture recognition	1030 (888–1254)	1079 (914–1251)	NS	960 (829–1163)	0.0001
Overall Attention	1246 (1160–1378)	1262 (1158–1426)	0.02	1194 (1058–1331)	0.0001
Overall Memory	3295 (2880–4108	3232 (2733–3823)	0.0001	3051 (2591–3687)	0.0001
Overall	4573 (4076–5498)	4550 (3928–5244)	0.003	4254 (3681–4976)	0.0001
Tests of accuracy (accuracy index)					
Choice	93 (90–97)	97 (93–100)	0.003	97 (93–100)	0.0001
Number vigilance	96 (86–98)	96 (91–100)	0.02	96 (91–100)	0.02
Memory	0.94 (0.79–1)	0.94 (0.8–1)	NS	0.94 (0.8–1)	NS
Word recognition	0.65 (0.5–0.77)	0.63 (0.51–0.75)	NS	0.65 (0.5–0.75)	NS
Picture recognition	0.85 (0.73–0.95)	0.8 (0.63–0.9)	0.0001	0.83 (0.69–0.9)	NS
Overall	2.36 (2.09–2.58)	2.27 (2–2.53)	0.002	2.35 (2.08–2.55)	NS

Fearn et al, Eur J Vasc Endovasc Surg 2003

Conflicting results

Cognitive improvement after CAS

	Successful Group (n=12)		
	Baseline	3 mo After Procedure	*P* Value
ADAS score	7.7±8.9	5.7±7.1	0.024
MMSE score	25.8±3.8	27.7±2.7	0.015
Color Trail Making A, seconds	123.2±68.6	99.3±51.5	0.017
Color Trial Making B, seconds	196.2±99.3	175.1±85.5	0.169
Verbal fluency	26.3±14.0	27.3±10.2	0.937
NIHSS score	0.6±0.9	0.4±0.7	0.157
Barthel Index	97.5±8.7	98.8±4.3	0.317

Lin et al, Stroke 2011

Conflicting results

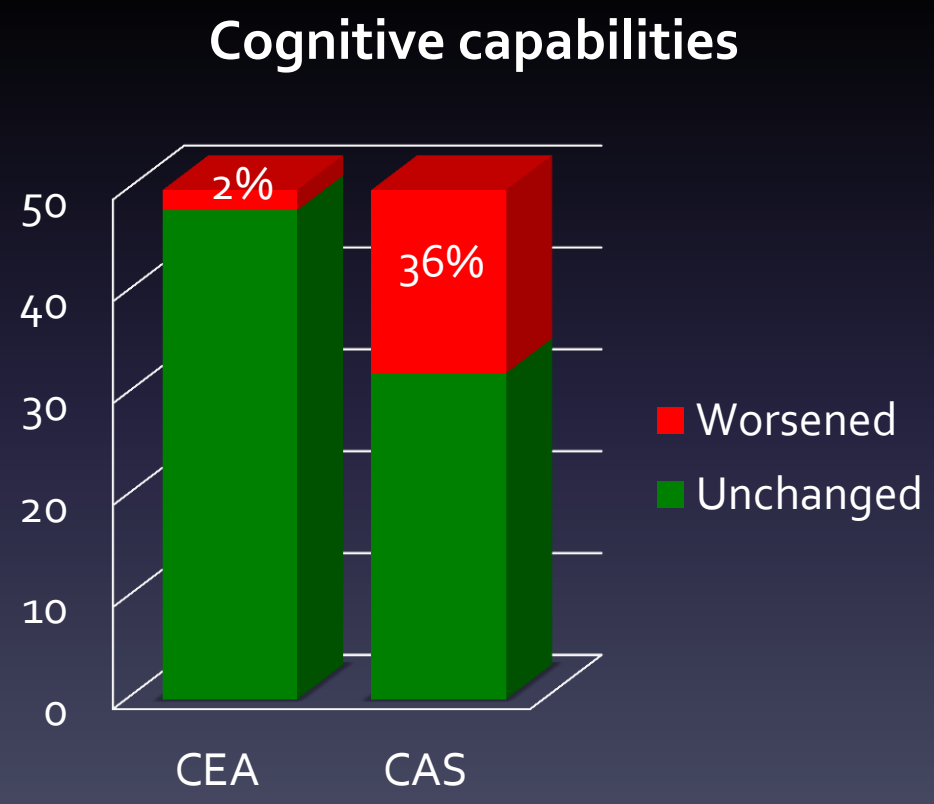
NO improvement after CEA

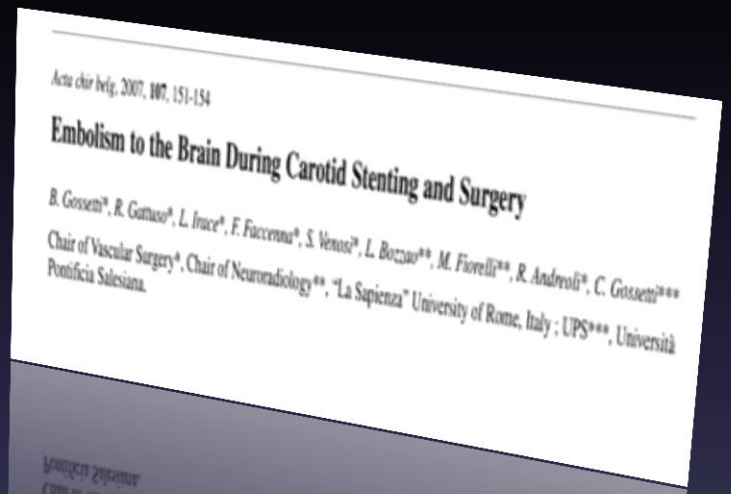
Test	Preoperative ($N=33$)	Postoperative ($N=32$)	Follow-up ($N=27$)	F	p
LNS	13.2±2.9	13.6±2.5	12.7±3.1	1.29	0.30
AVLT-1	4.5±1.9	4.5±1.5	4.4±1.4	0.14	0.87
AVLT-5	10±2.3	9.0±2.2	9.4±2.2	3.30	0.06
AVLT-SD	9.5±2.3	9.0±2.3	8.7±2.1	2.45	0.11
AVLT-LD	8.2±2.4	6.4±2.9	6.9±2.6	8.67	<0.01*
AVLT-R	12.3±2.1	11.5±2.6	11.2±2.4	3.24	0.06
TMT-B	136.8±47.8	141.2±80.6	130.9±39.8	0.26	0.77
HAM-D	4.9±6.2	4.4±4.8	4.7±4.8	0.39	0.68
HADS depression	3.8±3.4	3.3±2.7	3.2±3.2	1.41	0.26
HADS anxiety	5.3±3.4	4.0±3.5	3.7±3.2	2.92	0.07

Aleksic et al, Eur J Vasc Endovasc Surg 2006

Conflicting results

Cognitive function worsened





Acta chir belg, 2007, 107, 151-154

Embolism to the Brain During Carotid Stenting and Surgery

B. Gossetti*, R. Gattuso*, L. Irace*, F. Faccenna*, S. Venosi*, L. Bozzao**, M. Fiorelli**, R. Andreoli*, C. Gossetti***

Chair of Vascular Surgery*, Chair of Neuroradiology**, "La Sapienza" University of Rome, Italy ; UPS***, Università Pontificia Salesiana.

Gossetti et al, Acta Chir Belg 2007

Systematic review

- ✓ Cognitive function after CEA vs CAS
- ✓ 13 eligible studies (1999-2012)
- ✓ 403 CEAs/368 CAS

REVIEW

Comparison of Cognitive Function after Carotid Artery Stenting versus Carotid Endarterectomy

K.I. Paraskevas [a,*], C. Lazaridis [b], C.M. Andrews [c], F.J. Veith [d,e], A.D. Giannoukas [a]

[a] Department of Vascular Surgery, University Hospital of Larissa, Larissa, Greece
[b] Department of Neurology, Division of Neurocritical Care and Vascular Neurology, Baylor College of Medicine, Houston, TX, USA
[c] Department of Neurosciences, Medical University of South Carolina, Charleston, SC, USA
[d] Division of Vascular Surgery, New York University Langone Medical Center, New York, NY, USA
[e] Division of Vascular Surgery, The Cleveland Clinic, Cleveland, OH, USA

WHAT THIS PAPER ADDS

This article has reviewed the literature for studies evaluating the changes in cognitive function after carotid artery stenting (CAS) versus carotid endarterectomy (CEA). The majority of the 13 studies that were identified did not demonstrate a significant difference between the two procedures with regard to an effect on cognitive function. However, the lack of standardization of specific cognitive tests and timing of assessment of cognitive function after CAS and CEA do not allow for definite conclusions to be drawn. Future studies should address the limitations of the previous studies and systematically evaluate the effect of CAS and CEA on cognitive function.

The effect of carotid artery stenting (CAS) and carotid endarterectomy (CEA) on cognitive function is unclear. Both cognitive improvement and decline have been reported after CAS and CEA. We aimed to compare the changes in postprocedural cognitive function after CAS versus CEA. A systematic qualitative review of the literature was conducted according to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analysis statement for studies evaluating the changes in cognitive function after CAS compared with CEA. Thirteen studies (403 CEAs; 368 CAS procedures) comparing the changes in cognitive function after CEA versus CAS were identified. Most studies did not show significant differences in overall cognitive function or only showed a difference in a single cognitive test between the two procedures. A definitive conclusion regarding the effect of CAS versus CEA on cognitive function was not possible owing to heterogeneity in definition, method, timing of assessment, and type of cognitive tests. For the same reasons, performing a meta-analysis was not feasible. The lack of standardization of specific cognitive tests and timing of assessment of cognitive function after CAS and CEA do not allow for definite conclusions to be drawn. Larger, adequately-powered and appropriately designed studies are required to accurately evaluate the effect of CAS versus CEA on postprocedural cognitive function.

Article history: Received 28 August 2013, Accepted 14 November 2013, Available online 28 November 2013

Keywords: Carotid artery stenting, Carotid endarterectomy, Cognitive function

Paraskevas K, Lazaridis C, Andrews CM, Veith F, Giannoukas AD. EJVES 2014;47:221-31

Table 1. Studies comparing cognitive outcomes after carotid artery stenting (CAS) versus carotid endarterectomy (CEA).

Study (year)	Patient groups	Timing of assessment	Outcome
Sivaguru et al. (1999)[12,a]	63 symptomatic CEA vs. 53 PTA patients	Before and 6 mo after the procedure	No significant difference in the overall score between PTA and CEA
Crawley et al. (2000)[13,a]	26 symptomatic CEA vs. 20 PTA patients	Before, 6 wks after and 6 mo after the procedure	No significant differences between the two groups on any test at any of the assessment times. The only significant difference was found with the Grooved Pegboard (dominant hand), with CEA patients performing better at the 6-mo assessment compared with PTA (0.45 vs. −0.06, respectively; $p = 0.047$)
Witt et al. (2007)[14,b]	21 symptomatic CAS vs. 24 CEA patients	Before, 6 d after and 1 mo after the procedure	There were no differences between CAS and CEA in any neuropsychological outcome
Gossetti et al. (2007)[10,b]	50 CEA vs. 50 CAS patients (mixed population)	Before, at discharge and 2 mo after the procedure	• Microemboli were detected in 37 CEA (74%) and all 50 (100%) CAS procedures • Cognitive capability worsened in 18 patients after CAS (36%) and 2 after CEA (4%)
Jansen et al. (2008)[27,a]	17 symptomatic CAS patients vs. 10 CEA patients vs. 13 healthy controls	Before, 1 mo, and 6 mo after the procedure	• No difference in memory function ($p = 0.241$) and alertness ($p = 0.220$) between patients undergoing CAS vs. CEA • Memory function and alertness at 6 mo deteriorated in both groups compared with healthy controls (for CEA vs. controls: $p = 0.041$; for CAS vs. controls: $p = 0.003$)
Takaiwa et al. (2009)[25,a]	11 CEA vs. 15 CAS patients (mixed population)	Preoperatively, 1 wk, 3 mo, 6 mo, and 1 y postoperatively	• Both CEA and CAS demonstrated improved RBANS scores 3 mo postoperatively (for CAS: from 86.3 ± 11.0 to 100.3 ± 10.8; $p < 0.01$; for CEA: from 93.4 ± 12.5 to 106.8 ± 15.3; $p < 0.01$) which persisted at 1 y • CAS patients showed improved MMSE scores 1 wk postoperatively (from 27.7 ± 1.3 to 28.5 ± 1.6; $p < 0.01$), whereas CEA patients showed improved MMSE scores 6 mo postoperatively (from 28.0 ± 1.5 to 28.9 ± 0.7; $p < 0.01$)
Capoccia et al. (2010)[28,b]	20 asymptomatic CEA vs. 23 CAS patients	Preoperatively, ≤24 h postoperatively, and 6 mo after the procedure	• For CEA patients, the mean MMSE scores decreased non-significantly (from 26.1 ± 3.46 to 25.6 ± 3.27; $p = 0.67$) • For CAS patients, the mean MMSE scores decreased significantly (from 25.6 ± 4.46 to 22.9 ± 4.54; $p = 0.045$) • Between-group analysis showed a significant decrease in the postoperative score of CAS vs. CEA patients ($p = 0.03$) • At the 6-mo follow-up, the MMSE score showed an improvement in CAS patients (23.7 ± 4.58), while it was stable in the CEA group (25.9 ± 3.43; within- and between-group analysis p = NS)

Study (year)	Patient groups	Timing of assessment	Outcome
Feliziani et al. (2010)[21,b]	22 asymptomatic CEA vs. 24 CAS patients	Preoperatively (T0), at 3 (T3) and 12 (T12) mo postoperatively	• No significant differences were observed at T0, T3, and T12 between CEA and CAS patients (for CEA: from 27.8 ± 2.3 to 27.4 ± 2.4 and 27.6 ± 3.0; for CAS: from 27.2 ± 1.9 to 26.5 ± 2.8 and 27.7 ± 2.1) • CAS showed worse outcomes in the trail-making test part A compared with CEA (preoperatively: 52.9 ± 24.4 vs. 74.1 ± 37.7, for CEA vs. CAS, respectively; $p = 0.058$; at 3 mo: 63.2 ± 50 vs. 109.2 ± 74.4, for CEA vs. CAS, respectively; $p < 0.05$; at 12 mo: 55.6 ± 22.5 vs. 97.2 ± 51.0, for CEA vs. CAS, respectively; $p < 0.01$)
Lal et al. (2011)[22,b]	25 asymptomatic CEA vs. 21 CAS patients	1—3 d before and 4—6 mo after CEA/CAS	• The composite change score for the entire test battery improved in patients both after CEA and after CAS compared with their baseline values (+0.51 for CEA vs.+0.47 for CAS, respectively; p = NS) • CEA resulted in a deterioration of working memory index (a measurement of memory/concentration), while CAS improved it (change score: −0.41 vs. 0.46, for CEA vs. CAS, respectively; $p = 0.001$) • CAS resulted in a deterioration of the Processing Speed Index (a measurement of psychomotor speed), while CEA improved it (change score: −0.32 vs. 0.58, respectively; $p = 0.001$)
Altinbas et al. (2011)[23,a]	61 symptomatic CAS vs. 58 CEA patients	1 wk before and 6 mo after the procedure	• From baseline to 6-mo follow-up there was a significant decrease in the cognitive sumscore after CAS of 0.19 (95% CI: 0.10—0.29; $p < 0.0001$) and a non-significant decrease after CEA of 0.02 (95% CI: −0.16 to 0.21; $p = 0.825$) • Mean difference: −0.17 (95% CI: −0.38 to 0.03; $p = 0.092$) • Within the individual domains, the unadjusted change in the cognitive domain abstract reasoning was significantly worse after CAS (difference between changes: −0.22; 95% CI: −0.44 to 0.00; $p = 0.046$), but after adjustment for age, sex, and education this did not stay statistically significant. The lack of a difference in cognition between CAS with CEA may be explained by insufficient statistical power
Wasser et al. (2012)[29,b]		1 d before, 1—4 d after, and 3 mo after the procedure	• Patients < 68 y did not show any significant cognitive alteration after either CEA or CAS
	19 CAS vs. 27 CEA patients (mixed population)		• Patients ≥ 68 y treated by CAS demonstrated a significant deterioration in post- vs. pre-procedural scores ($p = 0.01$), but then their cognitive performance improved by 3 months ($p = 0.017$) • Patients ≥ 68 y treated by CEA demonstrated a significant deterioration in post- vs. pre-procedural scores ($p = 0.022$), which persisted at 6 mo ($p = 0.002$)
Zhou et al. (2012)[24,b]	16 CAS and 35 CEA patients (mixed population)	1—2 wks before and 1 mo after the procedure	• Microemboli after the procedure were found in 8 CAS (50%) and 3 CEA (8.6%) patients • There was a trend for a decrease in mean RAVLT scores for patients with procedure-related microemboli (from 37.2 ± 12 to 29.7 ± 9.3; $p = 0.0525$), whereas those without microemboli had a slightly increased RAVLT mean score (from 33.3 ± 8.8 to 34.2 ± 9.4; p = NS)
Capoccia et al. (2012)[26,b]	32 asymptomatic CEA vs. 28 CAS patients	Preoperatively, 1 d, 6 mo and 12 mo postoperatively	• New ischemic lesions were detected in 6 CAS vs. 1 CEA patients (21.4% vs. 3%, respectively; $p = 0.03$) • In CAS patients, new DW-MRI lesions were associated with MMSE score decline ($p = 0.001$) • At 12 months, patients presenting with new lesions showed lower MMSE scores ($p = 0.08$)

Limitations

1. Small sample size of most studies
2. Heterogeneity in definition
3. Heterogeneity in type of tests used to assess cognitive functions
4. Heterogeneity in time of assessment
5. Heterogeneity in patient inclusion (symptomatic and/or asymptomatic)

Paraskevas K, Lazaridis C, Andrews CM, Veith F, Giannoukas AD. EJVES 2014;47:221-31

Systematic review 2

Review

Neurocognitive Functioning after Carotid Revascularization: A Systematic Review

Maarten Plessers[a] Isabelle Van Herzeele[b] Frank Vermassen[b]
Guy Vingerhoets[a]

[a]Department of Experimental Psychology, Ghent University, and [b]Department of Thoracic and Vascular Surgery, Ghent University Hospital, Ghent, Belgium

Plessers et al, Cerebrovasc Dis Extra 2014

Systematic review 2

- ✓ Both improvement and deterioration in cognitive function can be observed following CEA or CAS
- ✓ Methodological variability and heterogeneity in patient selection, control group, timing of examination, testing and outcomes
- ✓ Future studies are needed with consistent methodology

Plessers et al, Cerebrovasc Dis Extra 2014

New data from China

579 pts with cerebral lacunar infarction and carotid artery stenosis for whom CAS was indicated vs matched control group of 552 healthy individuals

		Controls	Before CAS	1 month	6 months	1 year	2 years	3 years
MMSE		28.67 ± 1.72	27.79 ± 1.94 [a*]	27.98 ± 2.15 [a*]	28.38 ± 2.12 [a*,b**]	28.55 ± 1.98 [b**]	28.53 ± 2.03 [b**]	28.61 ± 1.89 [b**]
MoCA		20.91 ± 2.08	19.97 ± 2.17 [a*]	19.91 ± 1.99 [a*]	20.70 ± 2.31 [b**]	20.82 ± 2.18 [b**]	20.93 ± 2.41 [b**]	20.89 ± 2.03 [b**]
	Alternating trail test	0.67 ± 0.43	0.59 ± 0.50 [a*]	0.60 ± 0.59 [a*]	0.63 ± 0.42	0.63 ± 0.61	0.65 ± 0.44 [b*]	0.66 ± 0.48 [b*]
	Cube copying	0.66 ± 0.38	0.57 ± 0.67 [a*]	0.59 ± 0.87	0.60 ± 0.94	0.67 ± 0.85 [b*]	0.65 ± 0.41 [b*]	0.66 ± 0.38 [b**]
	Clock-drawing	1.81 ± 0.57	1.64 ± 0.38 [a*]	1.69 ± 0.45 [a*]	1.70 ± 0.79 [a*]	1.74 ± 0.74 [b**]	1.75 ± 0.96 [b*]	1.78 ± 0.83 [b**]
	Naming	2.46 ± 0.61	2.39 ± 0.84	2.39 ± 0.71	2.41 ± 0.47	2.40 ± 0.53	2.41 ± 0.50	2.41 ± 0.63
	Attention	4.31 ± 1.19	4.02 ± 1.48 [a*]	4.15 ± 1.33 [a*]	4.18 ± 1.16 [b*]	4.28 ± 1.62 [b**]	4.30 ± 1.54 [b**]	4.34 ± 1.49 [b**]
	Sentence repeating	1.41 ± 0.56	1.34 ± 0.64	1.35 ± 0.65	1.34 ± 0.68	1.38 ± 0.54	1.37 ± 0.69	1.38 ± 0.66
	Verbal fluency	0.35 ± 0.48	0.31 ± 0.39	0.32 ± 0.45	0.33 ± 0.51	0.34 ± 0.40	0.33 ± 0.38	0.34 ± 0.43
	Abstraction	0.68 ± 0.54	0.61 ± 0.72	0.61 ± 0.71	0.62 ± 0.67	0.63 ± 0.48	0.63 ± 0.62	0.64 ± 0.69
	AVLT-delayed recall	3.34 ± 1.16	3.09 ± 1.22 [a*]	3.16 ± 1.43 [a*]	3.25 ± 1.29 [b*]	3.29 ± 1.37 [b**]	3.32 ± 1.51 [b**]	3.32 ± 1.47 [b**]
	Orientation	5.71 ± 0.59	5.64 ± 0.74	5.65 ± 0.65	5.64 ± 0.62	5.65 ± 0.48	5.67 ± 0.55	5.70 ± 0.41

- ✓ CAS was associated with significantly improved cognitive function in cerebral lacunar infarction patients with severe stenosis

Brain infractions and cognitive function

Randomized trial

	Carotid endarterectomy ($n = 73$)	Carotid angioplasty and stenting ($n = 77$)	P†
Ipsilateral new brain infarctions	18 (25)	38 (49)	0·002
Volume of ischaemic lesion (cm^3)*	0 (0–0·025)	0 (0–0·250)	0·010‡
New brain infarctions > 0·5 cm^3	9 (12)	10 (13)	1·000
New brain infarctions in both hemispheres	0 (0)	15 (19)	< 0·001

	Changes after 24 h			Changes after 30 days		
	New infarction	No new infarction	P*	New infarction	No new infarction	P*
MMSE	−1·14; 0 (−1 to 0)	−0·15; 0 (−1 to 0)	0·046	−1·21; 0 (−1 to 0)	−0·58; 0 (−1 to 0)	0·921
Clock-drawing test	−0·63; 0 (−1 to 0)	−0·16; 0 (0 to 0)	0·029	−0·77; 0 (−1 to 0)	−0·72; 0 (−1 to 0)	0·730
Verbal fluency test	−0·94; 0 (−2 to 1)	0·13; 0 (−1 to 2)	0·048	−3·80; −2 (−6 to 0)	−2·71, −2 (−6 to 0)	0·253

Kuliha et al, Br J Surg 2015

Trying to overcome selection bias…

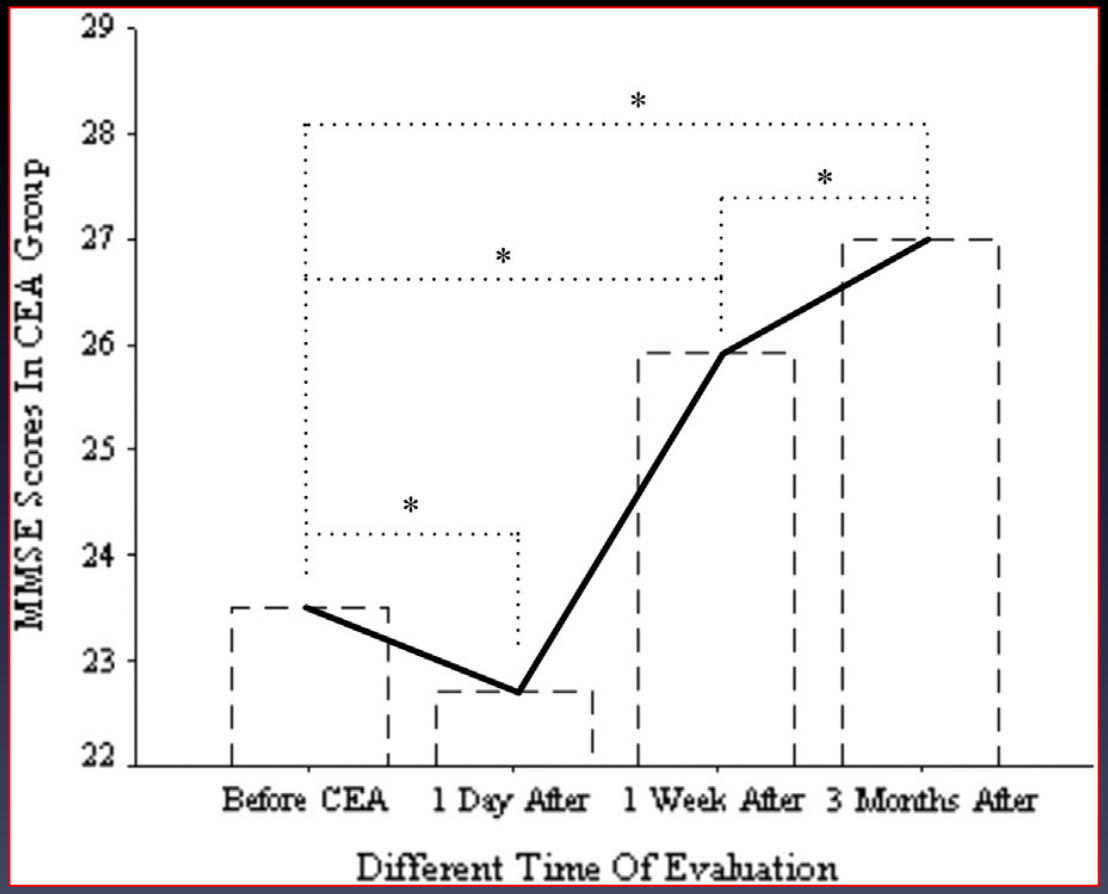
Improved visual, acoustic, and neurocognitive functions after carotid endarterectomy in patients with minor stroke from severe carotid stenosis

Lefeng Qu, MD, PhD,[a] Jiaxuan Feng, MD,[b] Sili Zou, MD,[a] Jun Bai, MD,[a] Zhen Hu, MD, PhD,[c] Mingjin Guo, MD, PhD,[d] and Zaiping Jing, MD, PhD,[b] *Shanghai, Fuzhou, and Qingdao, China*

Intergroup comparison[b]	*Improved by CEA*	*Not improved by CEA*
Ipsilateral	Visual acuity, visual field, and auditory acuity at all frequencies (250 Hz, 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz)	–
Contralateral	Visual field and auditory acuity at 1000 Hz were improved; auditory acuity at 2000 Hz and 4000 Hz showed no deterioration compared with medicine treatment	Visual acuity and auditory acuity at frequencies 250 Hz and 500 Hz
Neurocognitive scales performance	Cognitive function (by MMSE), neurologic function deficiency (by NIHSS), and independent living ability (by Barthel)	–

Qu et al, J Vasc Surg 2015

Time matters…



- ✓ Too short intervals may not be sufficient to detect neurocognitive changes

Qu et al, J Vasc Surg 2015

Carotid interventions and dementia

Conflicting results

Poor evidence

Seeking for answers…

- ✓ patients with impaired baseline perfusion might constitute a vulnerable population that may improve
- ✓ stroke patients could have fewer benefits of revascularization due to more permanent brain damage

Conclusion

While severe carotid stenosis appears to cause cognitive impairment in respect to the effects of CAS vs. CEA there is :

- **Marked inconsistency in the literature**
- **Mixed and heterogeneous results**

Future studies are needed

- **Standardization of neuropsychological testing**
- **Standardization of follow-up timing**
- **Incorporation of neuroimaging**

Thanks for the attention


LIVE
2016
Leading
Innovative
Vascular
Education
Organized by:
IVD INSTITUTE OF VASCULAR DISEASES
Institute of
Vascular Diseases (IVD), Greece
In collaboration with:
STONY BROOK UNIVERSITY MEDICAL CENTER
Stony Brook University
Medical Center, New York, USA
http://www.live2016.gr
May 26-28
2016
Ioannina
GREECE
LIVE 2016 Symposium
will be submitted to be approved
with CME credits by the EACCME of the UEMS