



# **CEA and CAS**

## **Lessons Learned from Randomized Controlled Trials**

**Peter Gloviczki, MD**

**The Joe M. and Ruth Roberts Professor of Surgery,  
Chair Emeritus, Division of Vascular and Endovascular Surgery,  
Director Emeritus, Gonda Vascular Center,  
Mayo Clinic, Rochester, MN,  
President-Elect, Society for Vascular Surgery**

---

**Meeting of the Medicare Evidence Development and Coverage Advisory Committee  
on The Management of Carotid Atherosclerosis**

**January 25, 2012,  
Baltimore, MD**

# Conflict of Interest

---

**None**

# Criteria of Outcome of Carotid Interventions

Stroke

Death

Cardiac complications

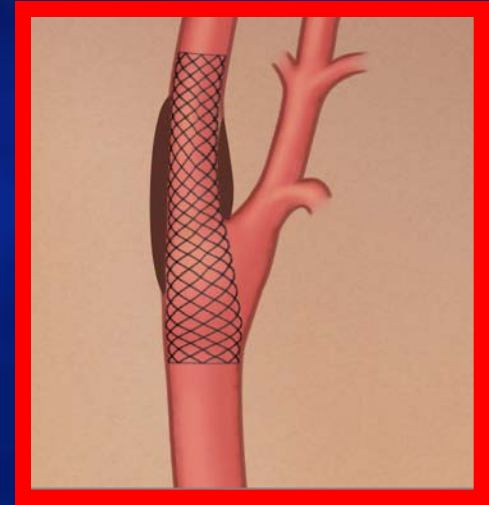
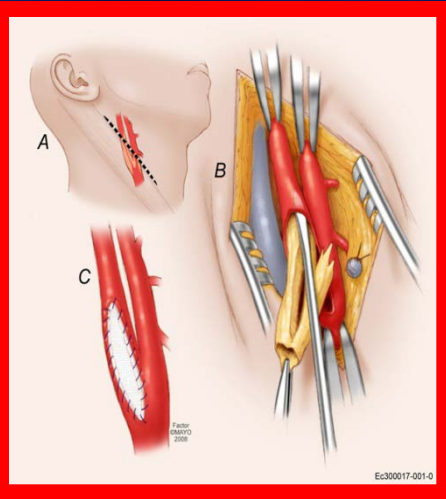
Cranial nerve injuries

Bleeding

Wound complications

Quality of Life

Cost



# CEA vs. BMT

## 1991-2004

N	Trial	Pts N.	Stenosis %	Symptoms	30 day Stroke/Death %	Risk reduction %	P value
1	NASCET	659	>70 50-69	+	5.8 6.7	16.5% ( 2 yr) 10.1% (5 yr)	<.001 <.05
2	ECST	3024	≥70	+	7.5	9.6% (3 yr)	<.01
3	VA Trial	189	>50	-	4.3	4.7% (1 yr)*	0.011
4	ACAS	1662	0	-	2.3	5.9% (5 yr)	.004
5	ACST	504	0	-	3	5.4% (5 yr)	<.0001

\* Ipsilateral stroke

# A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs stenting

Mohammad Hassan Murad, MD, MPH,<sup>a,b,c</sup> Anas Shahrour,<sup>a</sup> Nilay D. Shah, PhD,<sup>c</sup>  
Victor M. Montori, MD, MSc,<sup>a,c,d</sup> and John J. Ricotta, MD,<sup>c</sup> *Rochester, Minn; and Washington, DC*

**Objective:** The purpose of this systematic review and meta-analysis was to synthesize the available evidence derived from randomized controlled trials (RCTs) regarding the relative efficacy and safety of endarterectomy vs stenting in patients with carotid artery disease.

**Methods:** We searched MEDLINE, EMBASE, Current Contents, and Cochrane CENTRAL through July 2010 to update previous systematic reviews. Two reviewers determined trial eligibility and extracted descriptive, methodologic, and outcome data (death, nonfatal stroke, and nonfatal myocardial infarction). Random-effects meta-analysis was used to pool relative risks and the  $I^2$  statistic was used to assess heterogeneity.

**Results:** Thirteen RCTs proved eligible for analysis. The overall quality was moderate to high. Endarterectomy, stenting, and medical treatment had a relative risk [95% confidence interval (CI), 1.06-1.99; 1.00-1.99; 0.71;  $I^2 = 0\%$ ], and nonsignificant effect sizes were restricted to the two most recent studies. The results failed to be associated with a significant effect size (OR, 2.53; 95% CI, 1.27-5.08) and a nonsignificant effect size in patients opting for stenting rather than medical treatment after MIs. Outcome data in asymptomatic and symptomatic patients.

**Conclusion:** Compared with endarterectomy, carotid artery stenting (CAS) significantly increases the risk of any stroke and decreases the risk of MI. (J Vasc Surg 2011;53:792-7.)

**13 RCTs between 1998 and July 2010**  
**Included CREST, ICSS**  
**7484 patients**  
**80% with symptomatic carotid disease**

# **CEA and CAS**

## **Meta-analysis of 13 RCTs**

---

- **Quality of body of evidence: HIGH**
- **Methodological limitations of RCTs before 2008:**
  - **Allocation concealment in 6 of 11**
  - **Blinded outcome assessment in 2 of 11**
  - **Stopping early before full recruitment in 5 of 11**

**Murad et al. A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs stenting. J Vasc Surg 2011;53:792-7.**

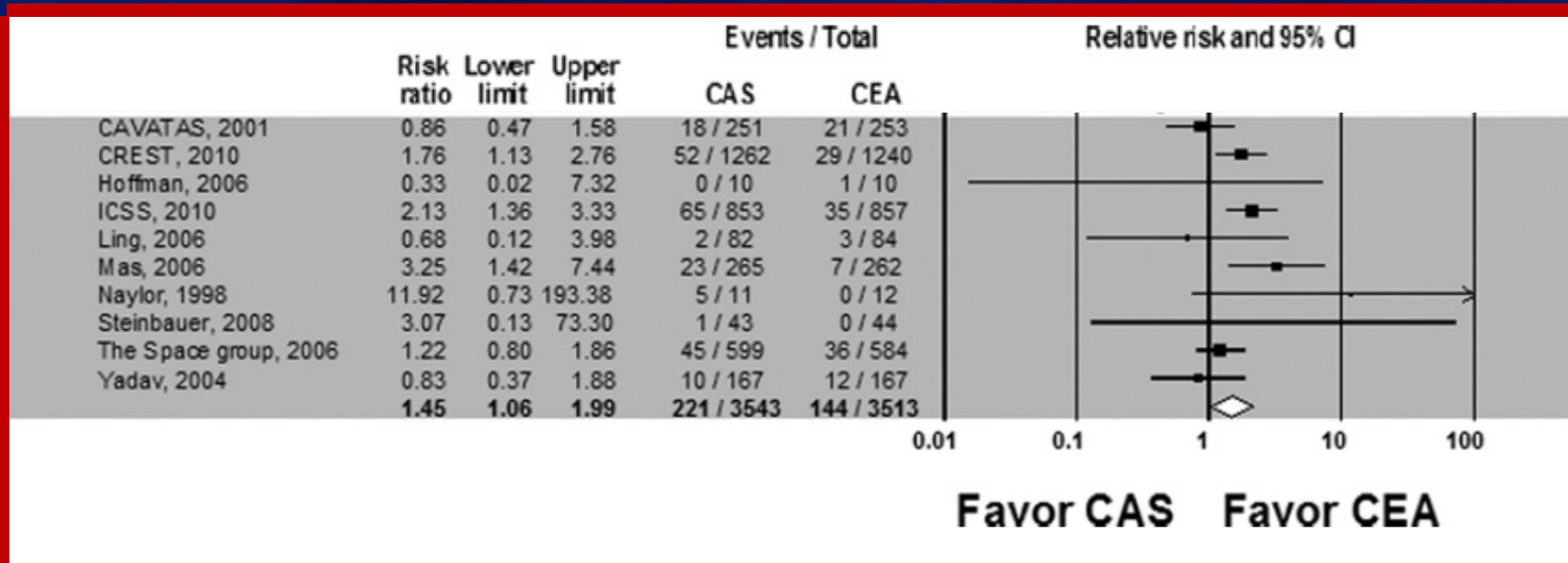
# CEA vs. CAS

## 13 RCTs, 7484 patients

N.	Trial/Year	Patients N.	EPD %	Asymptomatic %	Stenosis %
1.	Naylor, 1998	23	0	0	>70
2.	Alberts, 2001	219	0	0	>60
3.	Brooks, 2001	104	0	0	>70
4.	CAVATAS, 2001	504	0	3	?
5.	Brooks, 2004	85	0	100	>80
6.	Yadav, 2004	334	96	71	>50, >80
7.	EVA-3S, 2004	527	92	0	>60
8.	SPACE, 2006	1200	?	0	>70
9.	Ling, 2006	166	100	?	>50, >70
10.	BACASS, 2006	20	?	0	>70
11.	Steinbauer, 2008	87	0	0	>70
12.	CREST, 2010	2502	96	47	>50
13.	ICSS, 2010	1713	72	0	>50



# Any Stroke

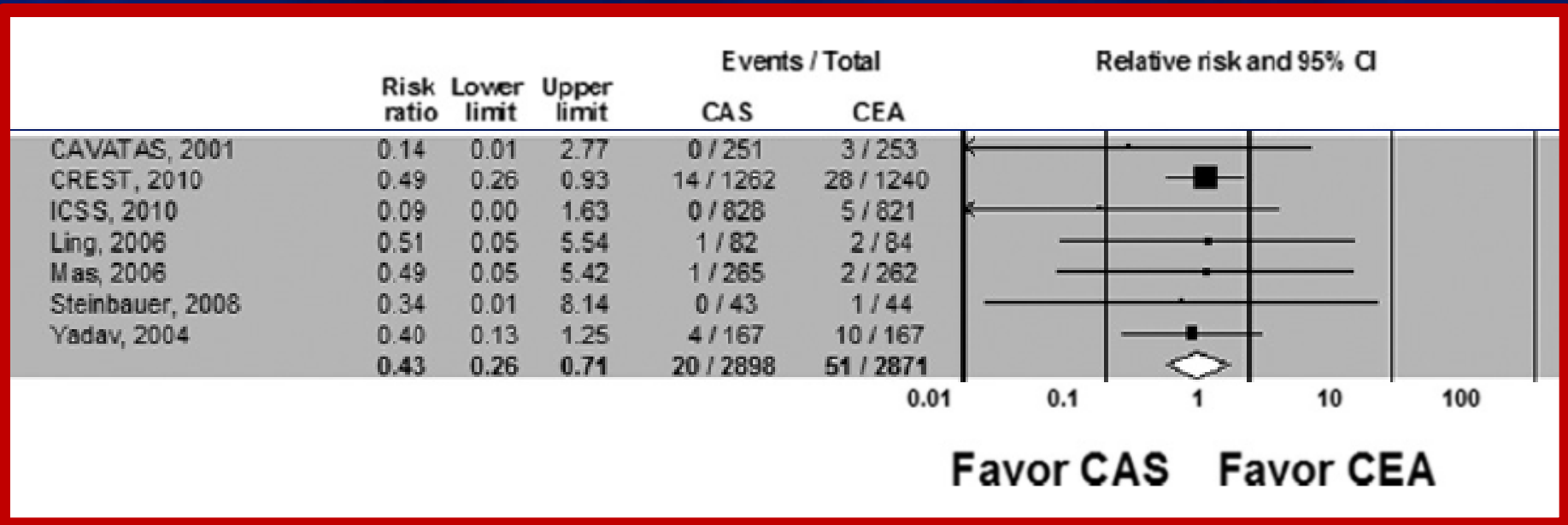


**CAS is associated with increased risk of any stroke  
(RR, 1.45; 95% CI 1.06-1.99,  $I^2 = 40\%$ )**

**Murad et al. A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs stenting. J Vasc Surg 2011;53:792-7.**

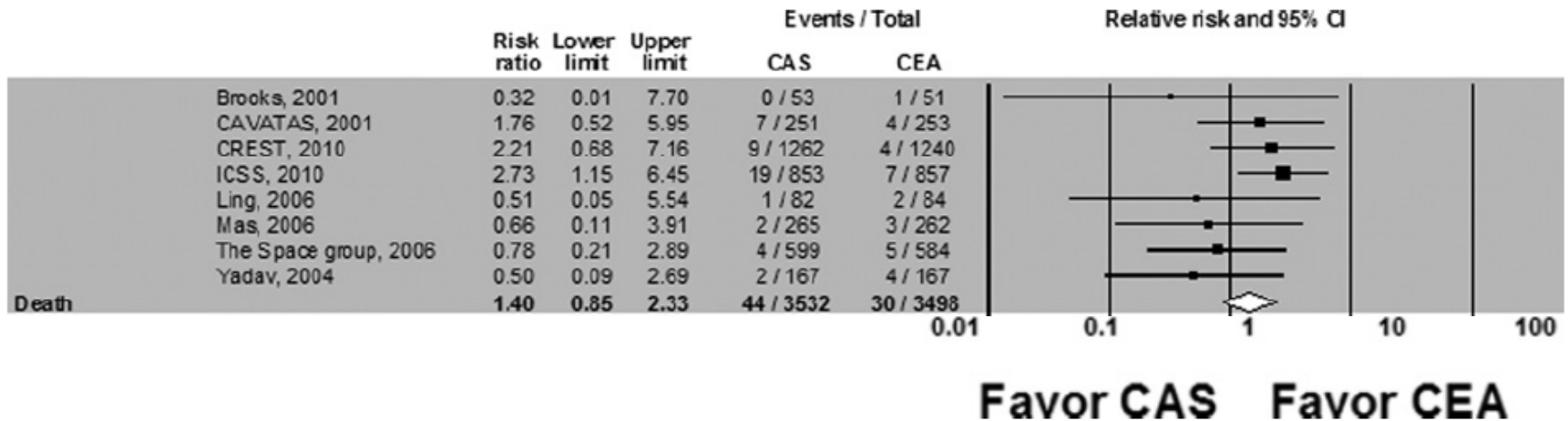


# Myocardial Infarction



**CAS is associated with decreased risk of MI  
(RR, 0.43; 95% CI 0,26-0,71,  $I^2 = 0\%$ )**

# Death



**CAS is associated with nonsignificant increase of death  
(RR, 1.45; 95% CI 1.06-1.99, I<sup>2</sup> = 40%)**

**Murad et al. A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs stenting. J Vasc Surg 2011;53:792-7.**

# Absolute Risk Difference per 1000 Patients

Outcome	Risk Difference (95% CI)	Quality of Evidence	Interpretation
Stroke	18.77 (-1,96-42.23)	High	CAS is associated with <u>19 more</u> strokes than CEA
Myocardial Infarction	-10.15 (-13.17 -5.16)	High	CAS is associated with <u>10 fewer</u> MIs than CEA
Death	3.44 (-1.29 – 11.44)	Moderate	CAS is associated with <u>3 more</u> deaths than CEA

**Murad et al. A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs stenting. J Vasc Surg 2011;53:792-7.**

# Risk of Stroke, MI and Death

<b>Trials</b>	<b>Stroke</b>	<b>MI</b>	<b>Death</b>
<b>13 RCTs</b>			
RR	1.45	0.43	1.40*
95% CI	1.06-1.99,	0.26-0.71	0.85-2.33
<b>CREST/ ICSS</b>			
RR	1.82	0.39*	2.53
95% CI	1.35-2.45	0.12-1.23	1.27 – 5.08

**\* nonsignificant**

**Murad et al. A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs stenting. J Vasc Surg 2011;53:792-7.**

# Subgroup Analysis

- No significant treatment interaction for symptoms, severity of stenosis, or gender
- There was a trend suggesting CAS is more efficacious in patients <70 years of age





# Direct Medicare Cost

## Markov analysis in symptomatic patients suitable for both CEA and CAS

- CAS produced less quality-adjusted life years (8.97 vs 9.84) than CEA
- CAS resulted in an incremental cost of \$17,700

Young KC et al. A cost effectiveness analysis of carotid artery stenting compared with endarterectomy. J Stroke Cerebrovasc Dis 2010;19:404-9.

# Conclusions

- In most patients with carotid stenosis who are candidates for intervention, CEA is preferred to CAS for reduction of all-cause stroke and periprocedural death (**GRADE 1, Level of Evidence B**)
- CEA is preferred over CAS in patients aged >70 years of age (**Grade 1, Level of Evidence: A**)

# Conclusions

---

- There are insufficient data to recommend CAS as primary therapy for neurologically asymptomatic patients with 70% to 99% diameter stenosis

**THANK YOU!**