

Carotid Endarterectomy vs. Carotid artery Stenting (Surgeon Perspective)

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Disclosures

- I have no relationship(s) with industry to disclose relevant to the content of this CME activity.

Background

- Stroke is the third leading cause of death in US
- Carotid disease causes 12-20% of strokes
- Stroke risk in carotid artery stenosis
 - Degree of stenosis
 - History of neurological symptom
- Carotid endarterectomy (CEA) has been shown to decrease the long term risk of stroke in extracranial carotid artery stenosis compared with medical therapy

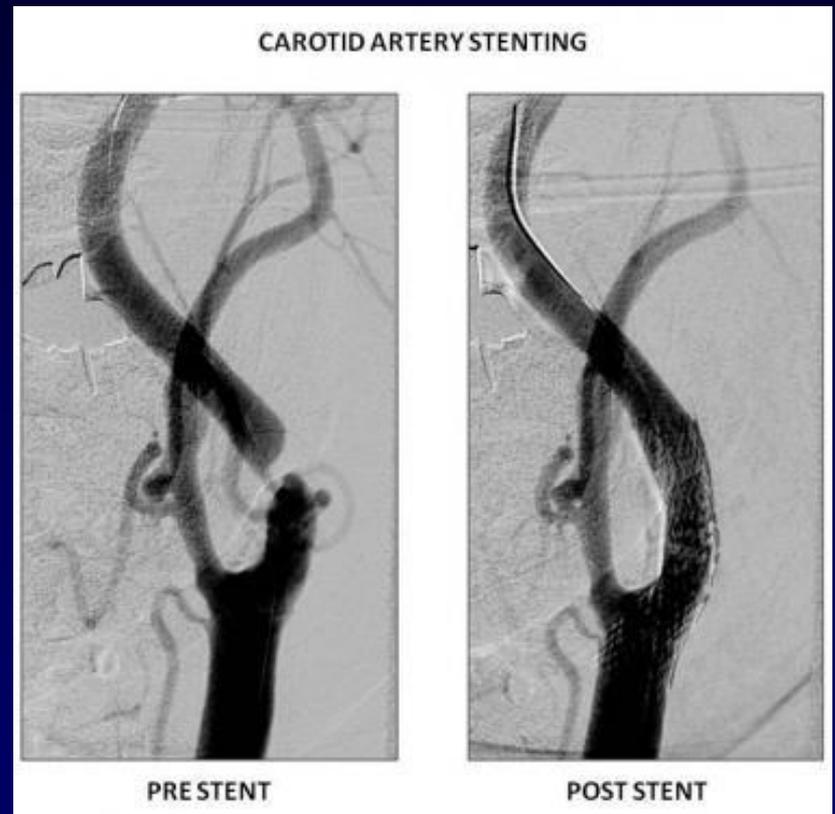
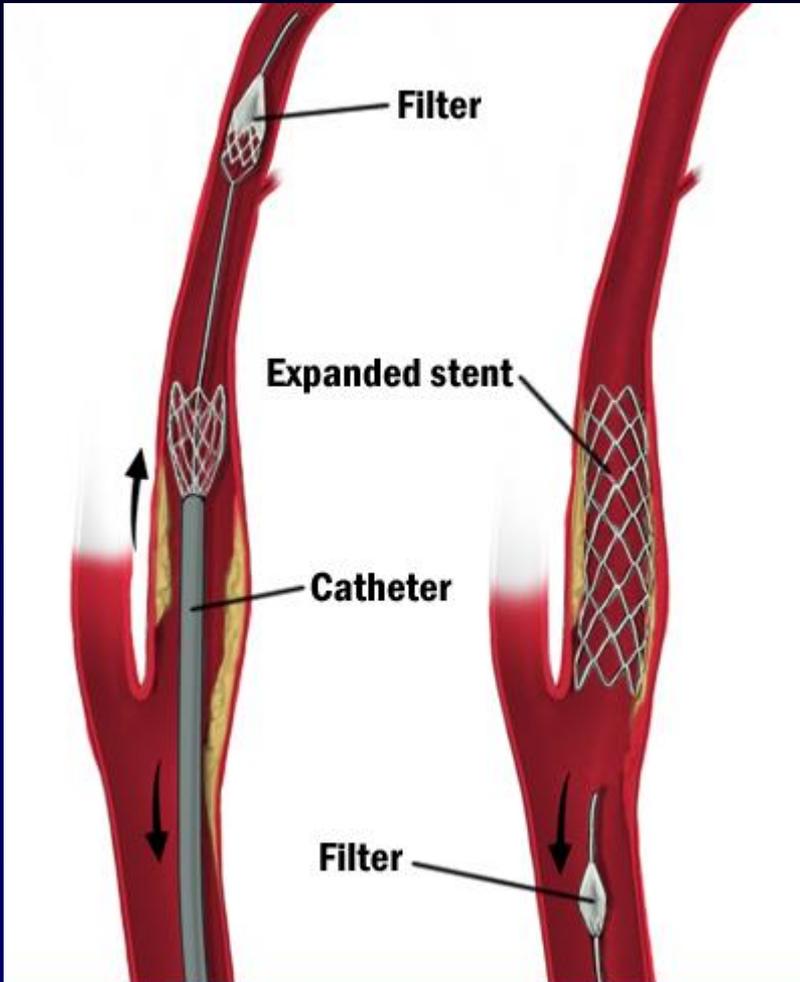
BMT vs. CEA

<i>Study</i>	<i>Population Studied</i>	<i>Patients</i>	<i>Stroke Rate BMT</i>	<i>Stroke Rate BMT + CEA</i>	<i>Study Conclusions</i>
NASCET ³	Symptomatic patients with carotid stenosis ≥70%	649	26% (2 yr) 28% (5 yr)	9% (2 yr) 13% (5 yr)	CEA is beneficial for symptomatic patients with ≥70% carotid stenosis ($P < .001$)
NASCET ⁴	Symptomatic patients with carotid stenosis ≥50%-69%	858	15% (2 yr) 22.2% (5 yr)	9% (2 yr) 15.7% (5 yr)	CEA is beneficial for symptomatic patients with ≥50% carotid stenosis ($P = .045$)
ECST ⁵	Symptomatic patients with carotid stenosis 80%-99% ECST (60%-99% by NASCET)	1279	20.6% (3 yr)	6.8% (3 yr)	CEA is beneficial for symptomatic patients with 60% carotid stenosis (NASCET) ($P < .0001$)
ACAS ⁶	Asymptomatic patients with carotid stenosis ≥60%	1662	11% (5 yr)	5.1% (5 yr)	CEA is beneficial for asymptomatic patients with ≥60% carotid stenosis ($P = .004$)
ACST ⁷	Asymptomatic patients with carotid stenosis ≥60%	3120	11.8% (5 yr)	6.4% (5 yr)	CEA is beneficial for asymptomatic patients with ≥60% carotid stenosis ($P ≥ .0001$)

Background

- Carotid artery angioplasty with stenting (CAS)
 - Less invasive and a viable option for treatment of carotid artery stenosis
 - Transfemoral approach
 - distal embolic protection (filter, flow reversal)
 - Periprocedural antiplatelet therapy

CAS



Background

- The increased use of CAS has been questioned, mainly by the surgical community
- No consensus on whether there is equipoise between both treatment approaches despite multiple randomized trials and registries

Background

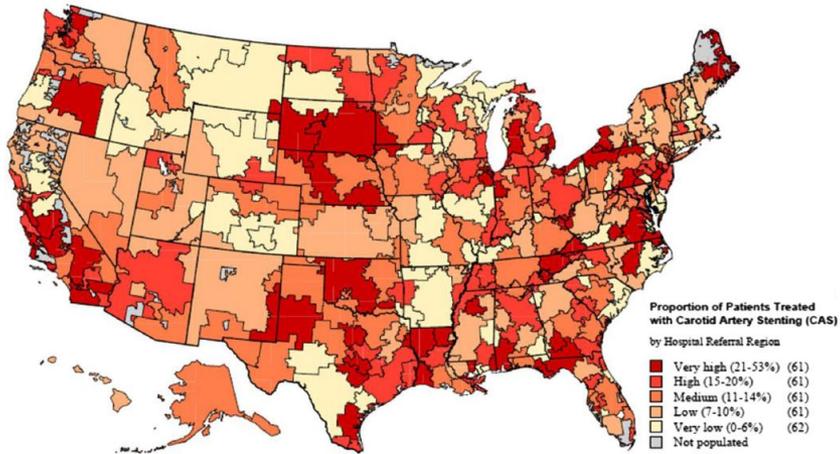
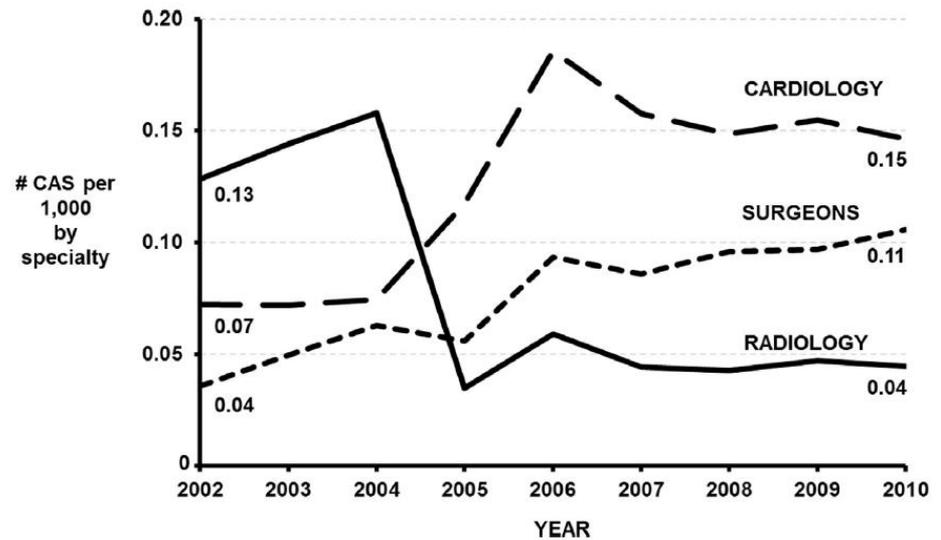


Fig 2. Regional variation in utilization of carotid artery stenting (CAS). Variation reflects the proportion of all carotid revascularization procedures that are CAS.



Societal Guideline

<i>Society</i>	<i>Symptomatic</i>	<i>Asymptomatic</i>
AHA	<ul style="list-style-type: none"> - CEA for 50%-99% stenosis - CAS as an alternative in patients at low risk of CAS associated complications or when CEA is high risk if complication rates are 4%-6% 	<ul style="list-style-type: none"> - CEA for 60%-99%, - CAS in selected patients, but its effectiveness is not well established
SVS	<ul style="list-style-type: none"> - CEA preferred in patients 50%-99% - CAS in hostile neck and severe uncorrectable cardiac conditions 	<ul style="list-style-type: none"> - CEA in good risk patients with 60%-99% stenosis and 3-5 yr life expectancy with complication rates >3%. - Insufficient data to support CAS outside trials, may be used by selected interventionalists with established complication rates <3%. - High risk patients should have BMT alone
ESC	<p>CEA for 70%-99% Stenosis CAS for high surgical risk</p>	<ul style="list-style-type: none"> - CEA for 60%-99% stenosis with complications <3% and 5-year survival, - CAS as an alternative in high volume centers with complications <3%
Australasian	<ul style="list-style-type: none"> - CEA for 50%-99% - CAS for patients at high surgical risk 	<ul style="list-style-type: none"> - CEA for 60%-99%, no evidence to support CAS, consider BMT as primary treatment

CAS versus CEA

- Randomized control trials in US and Europe
- SAPPHIRE
- EVA-3S, SPACE trial and ICSS trial
- The CREST study
- Meta-analysis

SAPPHIRE Study

- Stenting and angioplasty with protection for patients at high risk for CEA (SAPPHIRE)
- >50% symptomatic patients
- >80% asymptomatic patients
- 334 patients enrolled: CEA (n=167), CAS (n=167)
- Clinically significant heart disease, severe pulmonary disease, contralateral carotid occlusion, contralateral laryngeal nerve palsy, previous neck surgery or radiation, recurrent stenosis after CEA
- Age >80 years

SAPPHIRE Study

- cumulative death/MI/Stroke lower in CAS
 - 30 days: CAS 9.8% vs CEA 4.4%
 - 1 year: CAS 12.2 vs CEA 20.1%, $p=.004$)
- Differences more evidence in asymptomatic patients (9.9 vs 21.5% in CEA)
- Poor outcome in CEA was mainly cardiac morbidity
- At three years (2008): primary end point plus death or ipsilateral stroke no difference in long-term outcome
- CAS (24.6%) versus CEA (26.9%)

EVA-3S, SPACE, ICSS

- Conducted in France, Germany and Great Britain
- Published between 2006 to 2010
- Included patients with symptomatic carotid artery stenosis and average surgical risk
- ?Technical inexperience of most interventionists

EVA-3S

- Endarterectomy Versus Angioplasty in patients with Symptomatic Severe carotid Stenosis
- 527 patients symptomatic patients >60% stenosis
- Trial ended prematurely due to high risk of stroke and death in CAS
- Cumulative probability of procedural stroke or death, and non procedural stroke was higher in CAS (11.1 vs. 6.2%, p=.03)
- Stroke derived mainly from periprocedural complication rate.

SPACE

- 1196 patients with symptomatic carotid artery stenosis (>70% stenosis)
- At 2 years follow up
- No significant difference in the incidence of the composite endpoint stroke/death (9.5% vs 8.8%, $p=.31$)
- Recurrent stenosis (>70% stenosis) was significantly higher in CAS (10.7% vs 4.6%, $p=.0007$)

SPACE

- Trial stopped due to futility and cost
- Conclusion: failed to prove non-inferiority of CAS with CEA for higher periprocedural complication rate

ICSS Trial

- International Carotid Stenting Study
- 1713 symptomatic patients (>50% stenosis)
- Higher incidence of combined stroke, death and MI at 4 months in the CAS group (8.5% vs 5.2%, $p=.006$)
- No different in MI and cardiac death in two treatment groups.
- Conclusion: CEA should remain treatment of choice

CREST Study

- Carotid Revascularization Endarterectomy vs Stent Trial (CREST)
- Randomized trial to compare efficiency of CAS in patients with average risk
- Strict accreditation phase to eliminate the learning curve
- 2502 patients with carotid artery stenosis
 - Trial concluded in 2008
 - 53% symptomatic patients
 - Median follow up of 2.5 years

CREST Study

- Composite end point of death/MI/Stroke was no different between CAS and CEA (7.2% vs 6.8%, HR 1.11, $p=.51$)
- Higher MI in CEA (1.1% vs 2.3%, $p=.03$)
- Higher 30-days stroke in CAS (4.1 vs 2.3%, $p=.01$)
- No different in incidence of major stroke (0.9% in CAS and 0.7% in CEA)

CREST Study

- At 1-year: impact quality of life was greater reduced in patients with major or minor stroke but not those in MI
- Age appeared to influence treatment outcomes
 - Age >70 years better with CEA
 - Age <70 years better with CAS
- CREST II study

Meta-analysis

- EVA-3S, SPACE, ICSS trials
- Early results (120 days from inclusion)
- Total of 3433 patients
- Incidence of any stroke or death in CAS was significantly higher than CEA (8.9% vs 5.8%, $p=.0006$)
 - Twofold higher rate of complications for CAS in patients >70 years (12% vs 6%, $p=.053$)
 - No difference in risk of stroke or death in patients younger than 70 years

Meta Analyses

CEA vs. CAS

Reference	No. of Trials	No. of Patients	Stroke OR (95% CI)	Death OR (95% CI)	MI OR (95% CI)	S/D OR (95% CI)
Bonati et al ¹¹⁶	16	7572	Favors CEA 1.81 (1.40-2.34)	No difference 1.59 (0.94-2.70)	Favors CAS 0.44 (0.28-0.87)	Favors CEA 1.75 (1.29-1.31)
Liu et al ¹¹⁷	13	7501	Favors CEA 1.87 (1.40-2.40)	No difference 1.43 (0.85-2.40)	Favors CAS 0.43 (0.26-0.71)	Favors CEA 1.59 (1.30-1.93)
Economopoulos et al ¹¹⁹	13	7477	Favors CEA 1.23 (1.23-1.91)	No difference 1.49 (0.93-2.37)	Favors CAS 0.49	Favors CEA 1.54 (1.25-1.89)
Yavin et al ¹²⁰	12	6973	Favors CEA 1.72 (1.20-2.47)	No difference 1.11 (0.56-2.18)	Favors CAS OR 0.47 (0.29-0.78)	—
Bangalore et al ¹²¹	13	7477	Favors CEA 1.31 (1.08-1.59)	Not reported	Favors CAS OR 0.45 (0.28-0.71)	Favors CEA 1.65 (1.34-2.02)
Guay ^{118*}	10	6950	Favors CEA 0.50 (0.38-0.67)	No difference 0.72 (0.42-1.24)	Favors CAS 2.16 (1.32-3.54)	—
Murad et al ⁴⁷	—	—	Favors CEA 1.45 (1.06-1.99)	No difference 1.40 (0.85-2.33)	Favors CAS 0.43 (0.26-0.71)	—

CEA vs CAS

- SAPPHERE: equivalent in **high risk** patients
- **Average risk** patients in symptomatic patients
- EVA-3S: stopped due to poor CAS outcomes
- SPACE: failed to show non-inferiority of CAS with CEA
- ICSS: CEA should be choice of treatment
- CREST: outcomes equivalent, CEA had more MI, CAS more stroke

Symptomatic Carotid Artery Stenosis

- Risk of death or stroke for CAS is higher than CEA, especially in patients >70 years
- CAS is acceptable in symptomatic patients with high surgical risk
- Major anatomical risk for CEA
- Most symptomatic carotid artery stenosis is better treat with CEA

Asymptomatic Carotid Artery Stenosis

- Medical therapy
- Asymptomatic patients younger than 70 years can be treated equally with CEA or CAS
- CAS should be avoided in elderly patient

- Higher surgical risk with severe degree of stenosis
- CAS and CABG/heart surgery
- ? Contralateral carotid occlusion

Thank you

Question?

