Carotid Endarterectomy vs. Carotid artery Stenting

(Surgeon Perspective)

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NC VH
New Cardiovascular Horizons

LSU Health
SHREVEPORT

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

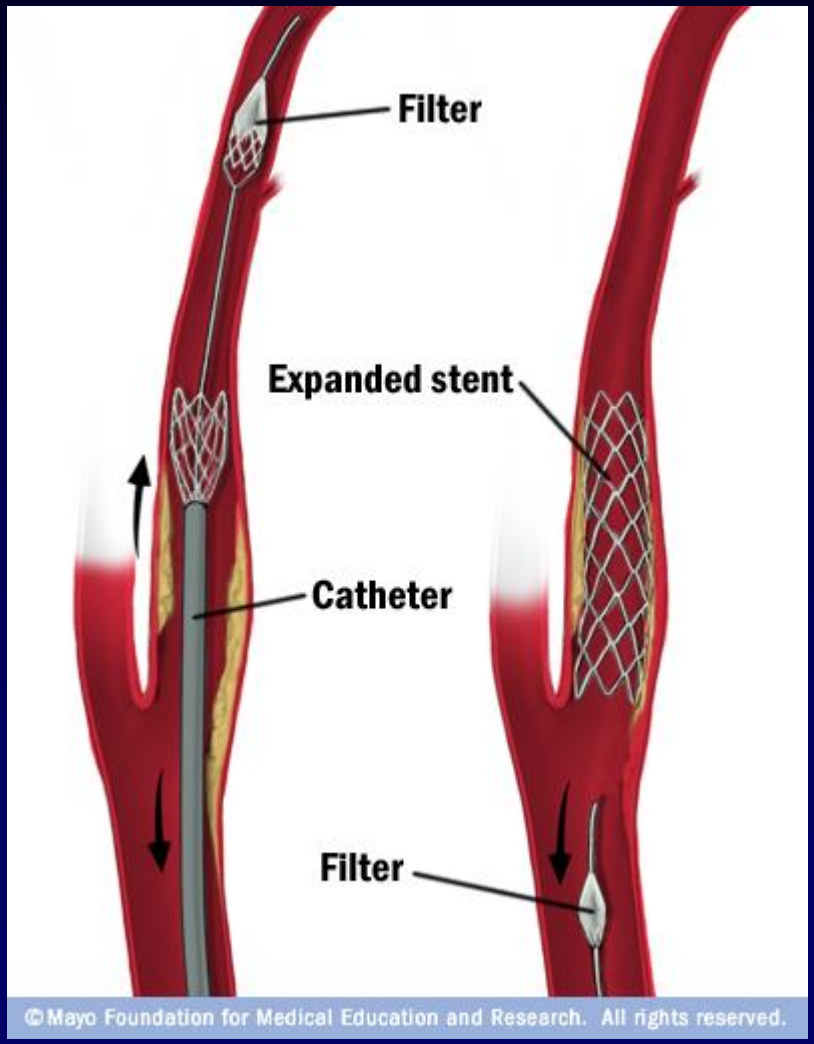
BMT vs. CEA

Study	*Population Studied*	*Patients*	*Stroke Rate BMT*	*Stroke Rate BMT + CEA*	*Study Conclusions*
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% cartoid 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% cartoid 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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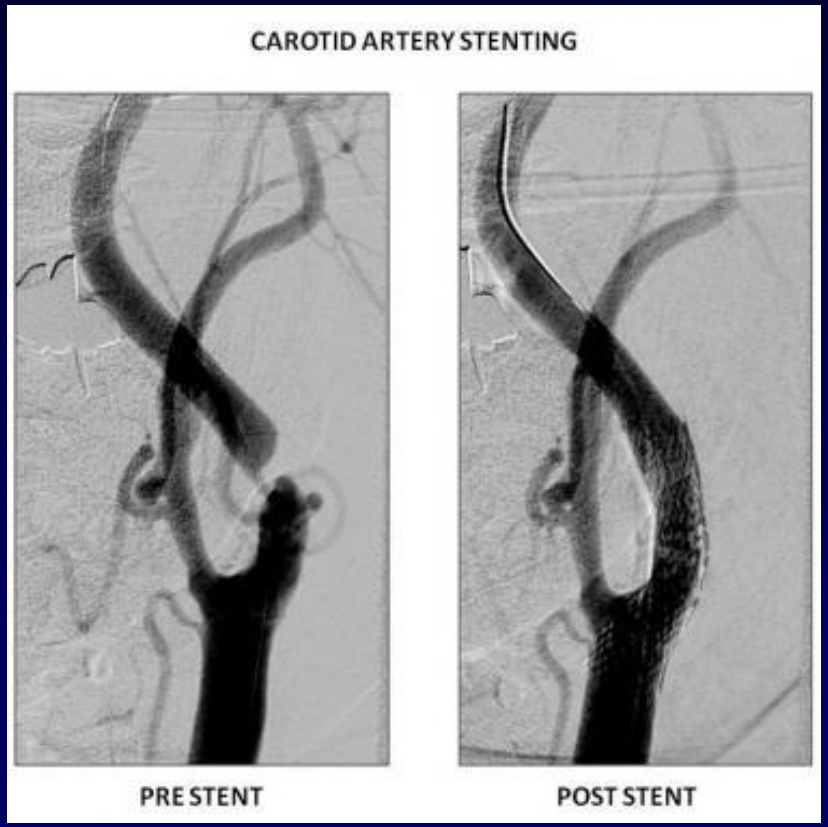

CAROTID ARTERY STENTING
PRE STENT
POST STENT

Background

- The increased of CAS has been questioned, mainly by surgical community

- No consensus on whether there is equipoise between both treatment approaches despite multiple randomized trials and registries

Background

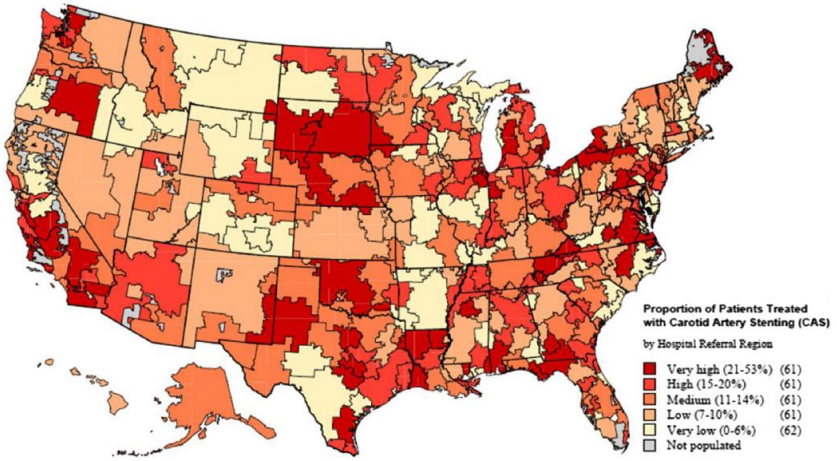
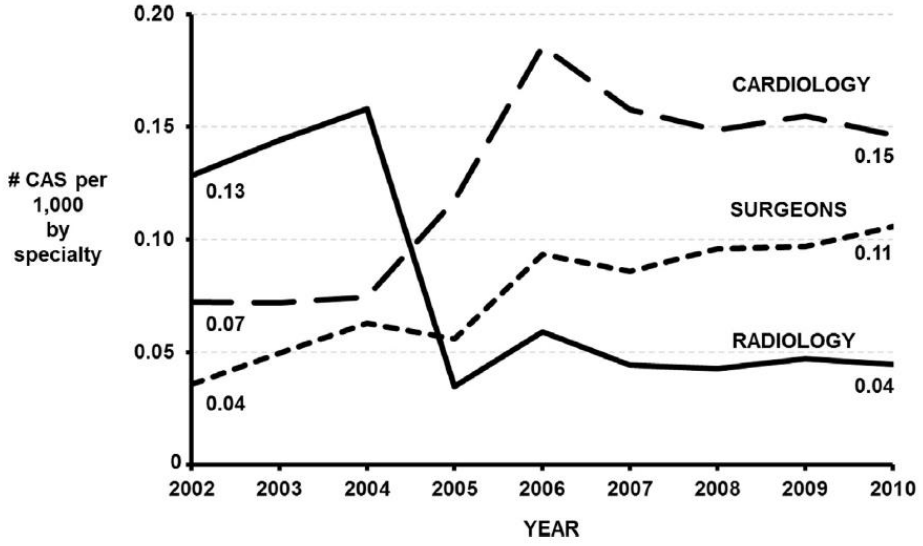


Fig 2. Regional variation in utilization of carotid artery stenting (*CAS*). Variation reflects the proportion of all carotid revascularization procedures that are CAS.



Societal Guideline

Society	*Symptomatic*	*Asymptomatic*
AHA	- 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%	- CEA for 60%-99%, - CAS in selected patients, but its effectiveness is not well established
SVS	- CEA preferred in patients 50%-99% - CAS in hostile neck and severe uncorrectable cardiac conditions	- 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	CEA for 70%-99% Stenosis CAS for high surgical risk	- CEA for 60%-99% stenosis with complications <3% and 5-year survival, - CAS as an alternative in high volume centers with complications <3%
Australasian	- CEA for 50%-99% - CAS for patients at high surgical risk	- 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%
  - I 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 different 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

- SAPPHIRE: equivalent in **high risk** patients

- **Average risk** patients in symptomatic patients
- EVA-3S: stopped due to poor CAS outcomes
- SPACE: failed to showed 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?