Current Status of Carotid Artery Stenting (CAS)

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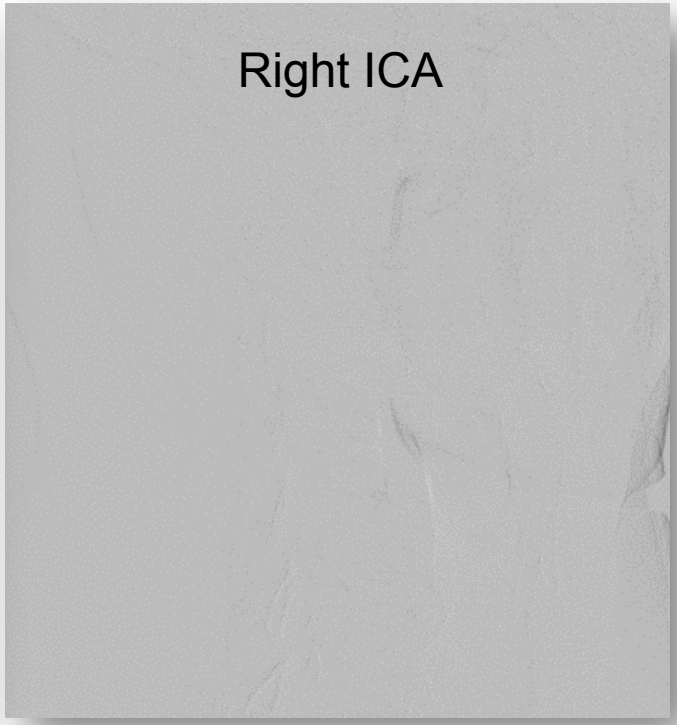
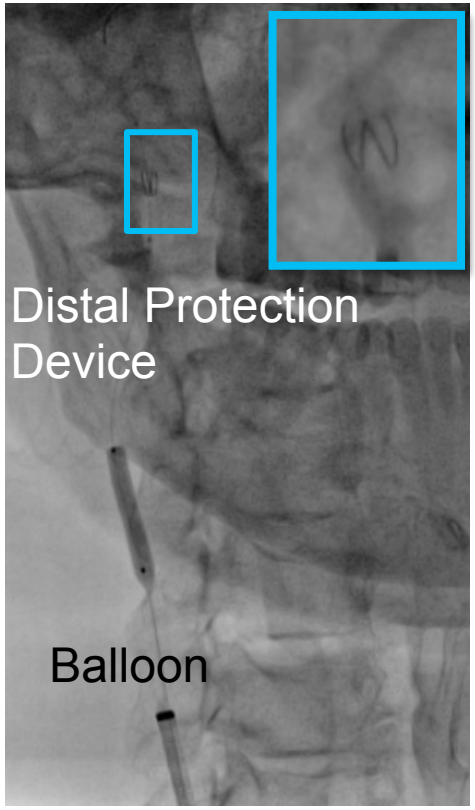
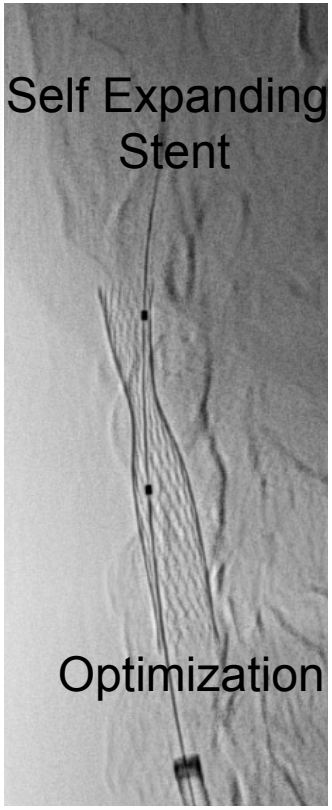
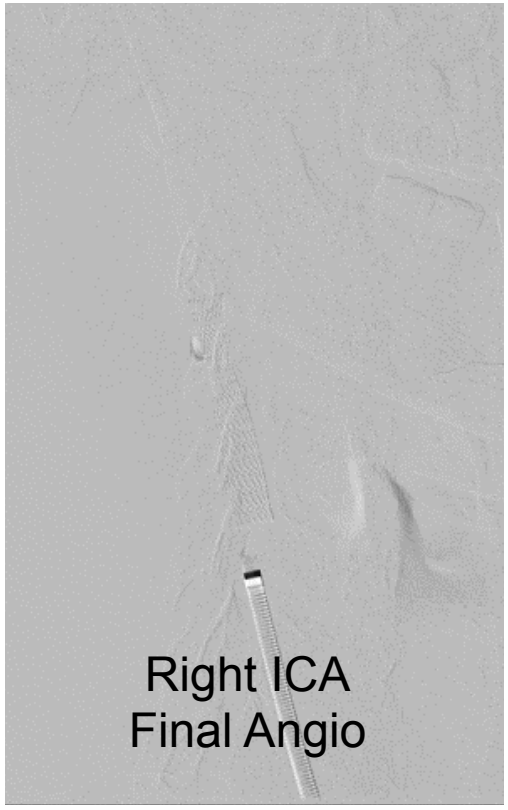
Carotid Artery Stenting



Carotid Artery Stenting







Carotid Artery Stenting(CAS)

CEA > 50 Yrs

VS

CAS >15 yrs

CAS Vs CEA. Randomized Trials

Six Major RCTs (2001-2010)

CAVATAS
SAPPHIRE
SPACE
EVA-3S
ICSS
CREST

- Randomized a total of 6780 pts to CAS Vs CEA
- Both symptomatic & asymptomatic patients were included
- Highly heterogenous in the design and conduct of trial esp the rate of use of stent, EPDs ,DAPT and the performance skill of the operators

- Periprocedural stroke rate was more common with CAS
- Periprocedural MI was more common with CEA associated with increased long term mortality
- Increase in the restenosis with CAS with no clinical impact

CAS Vs CEA. Meta-analysis

3754 pts treated with CAS, 3723 pts treated with CEA

At 30 days : Elevated risk of stroke ($p<0.001$)

Death or stroke ($p<0.001$) but reduced rate of MI ($p=0.003$) and Cranial nerve injuries ($p<0.001$) with CAS compared to CEA

Beyond 30 days : Ipsilateral stroke prevention, restenosis and the need for repeat revascularization were comparable in all trials

Economo Poulos K P et al Stroke 2011,42:687-692

CAS Vs CEA. Major Registries

Name	Year	D/S	D/S/MI	D/S sympt	D/S asymp
CAPTURE	2007	5.7%	6.3%	10.6%	4.9%
CASES PMS	2007	4.5%	5.0%	NR	NR
PRO-CAS	2008	3.6%	NR	4.3%	2.7%
SAPPHIRE-W	2009	4.0%	4.4%	NR	NR
SVS	2009	NR	5.7%	NR	NR
EXACT	2009	4.1%	NR	7.0%	3.7%
CAPTURE-2	2009	3.4%	NR	6.2%	3.0%
Mercogliano	2010	1.4%	1.4%	3.0%	0.8%
Krakow	2012	NR	2.6%	3.6%	1.5%
CABANA	2014	4.1%	4.6%	NR	NR

- 10 large scale registries enrolling over 1000 pts for a total of 23511pts treated
- The use of EPD was mandatory in most trials
- Overall 30 days death, stroke or MI 1.4 to 6.3%
- Several registries included only high risk pts
- The event rates have decreased over the years

Carotid Angioplasty With Stenting Versus Endarterectomy

10-Year Randomized Trial in a Community Hospital

William H. Brooks, MD,* Michael R. Jones, MD,* Paula Gisler, PHD,*
Rick R. McClure, MD,† Timothy C. Coleman, MD,* Linda Breathitt, RN,*
Cheryl Spear, RN*

Lexington, Kentucky

- **No difference in the risk of death or ipsilateral stroke for pts assigned to CEA or CAS.**
- **Risk of MI was highest among pt who presented with symptoms and who were assigned to CEA.**

Conclusions Long-term protection against ipsilateral stroke provided by CAS and CEA did not differ in this trial. The 10-year risk of fatal/nonfatal myocardial infarction was highest in all patients harboring symptomatic carotid stenosis at enrollment. The risk of fatal/nonfatal heart attack was significantly more prevalent in those symptomatic or asymptomatic patients randomized to CEA. (J Am Coll Cardiol Intv 2014;7:163–8)

CAS Vs CEA .Ongoing RCTS
(Asymtomatic Pts)

SPACE -2 A CEA + Best Medical Treatment
Vs
Best medical treatment alone

SPACE -2B CAS + Best Medical Treatment
Vs
Best Medical Treatment

ACST -2 CEA Vs CAS

ACT I CEA Vs CAS

CREST -2 CAS Vs No CAS
CEA Vs No CEA
Medical Treatment will be uniform in both groups

- These trials will not answer the issue of symptomatic carotid stenosis patients
- Even for the included asymptomatic patients the trial results only give indirect comparisons between CAS and CEA.

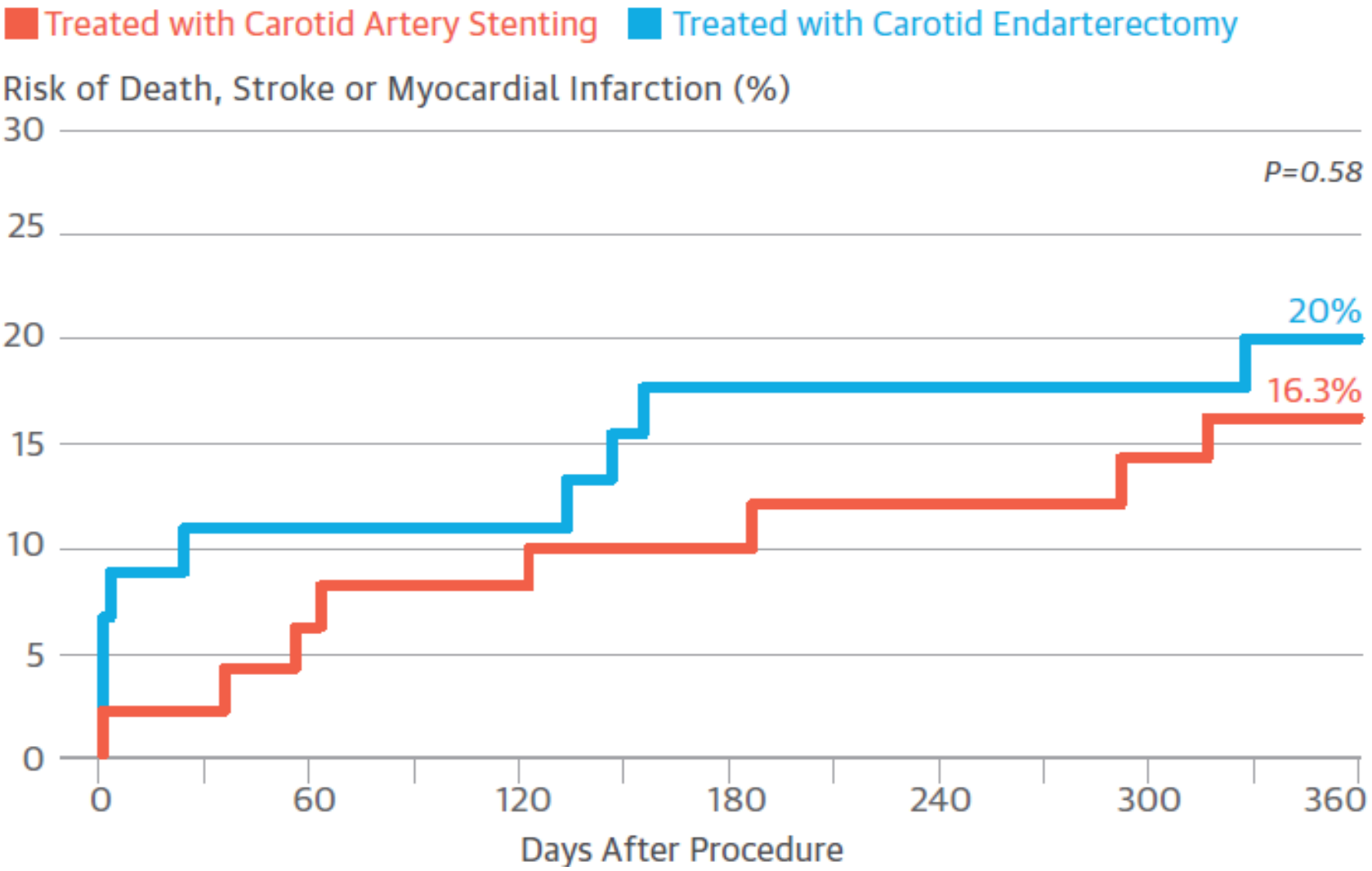
The choice between CAS and CEA

- Local Expertise.
- Risk for CEA.
- Risk for CAS

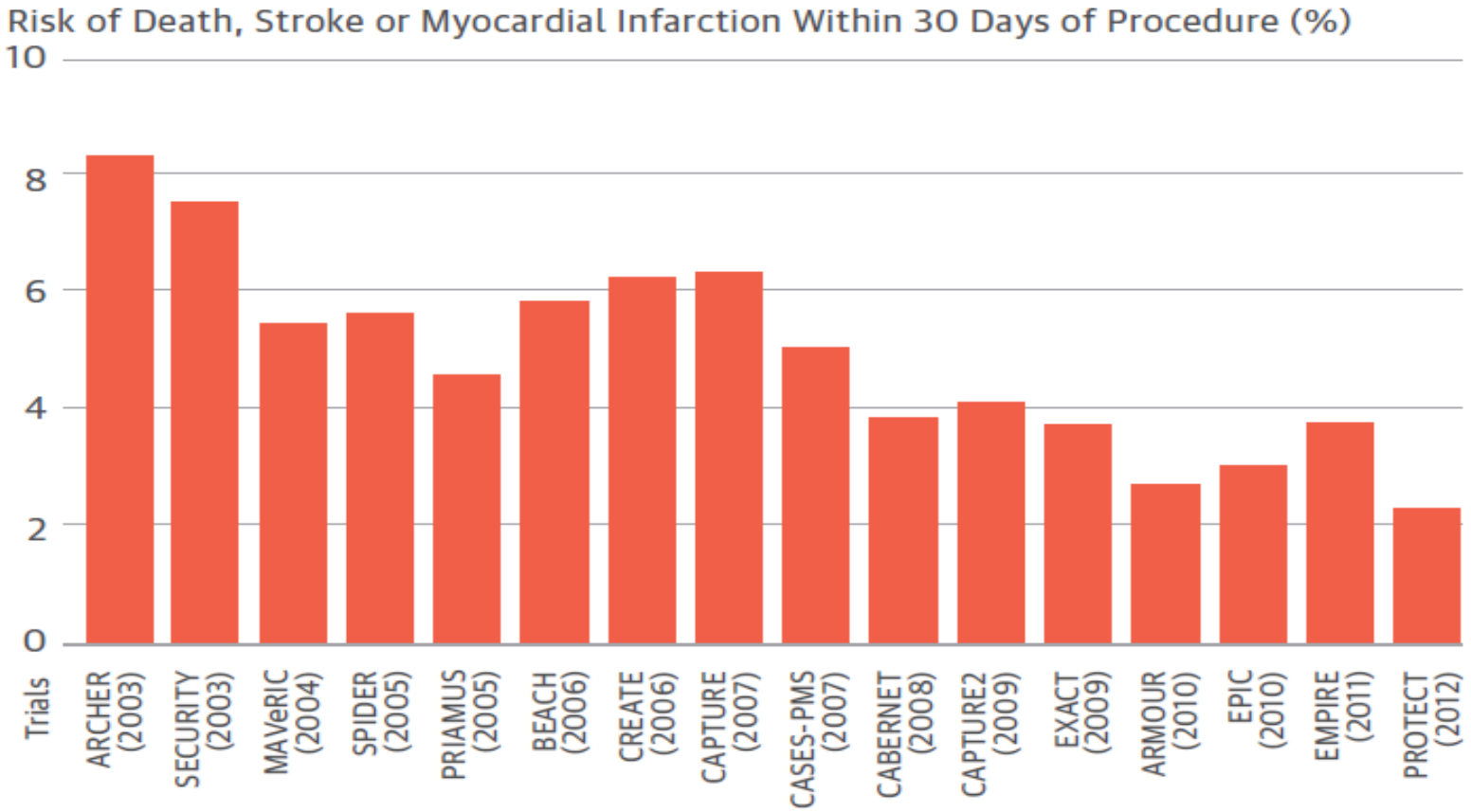
High Risk Features For CEA

Medical Comorbidity	Anatomic Criteria
Elderly (>75/80 yrs)	Surgically inaccessible lesions
Congestive heart failure (NYHA functional class III/IV)	At or above C2
Unstable angina (CCS III/IV)	Below the clavicle
CAD with ≥2 vessels ≥70% stenosis	Ipsilateral neck irradiation
Recent myocardial infarction (≤30 days)	Spinal immobility of the neck
Planned open heart surgery (≤30% days)	Contralateral carotid artery occlusion
Ejection fraction ≤30%	Laryngeal palsy
Severe pulmonary disease (COPD)	Tracheostoma
Severe renal disease	Previous ipsilateral CEA or neck surgery

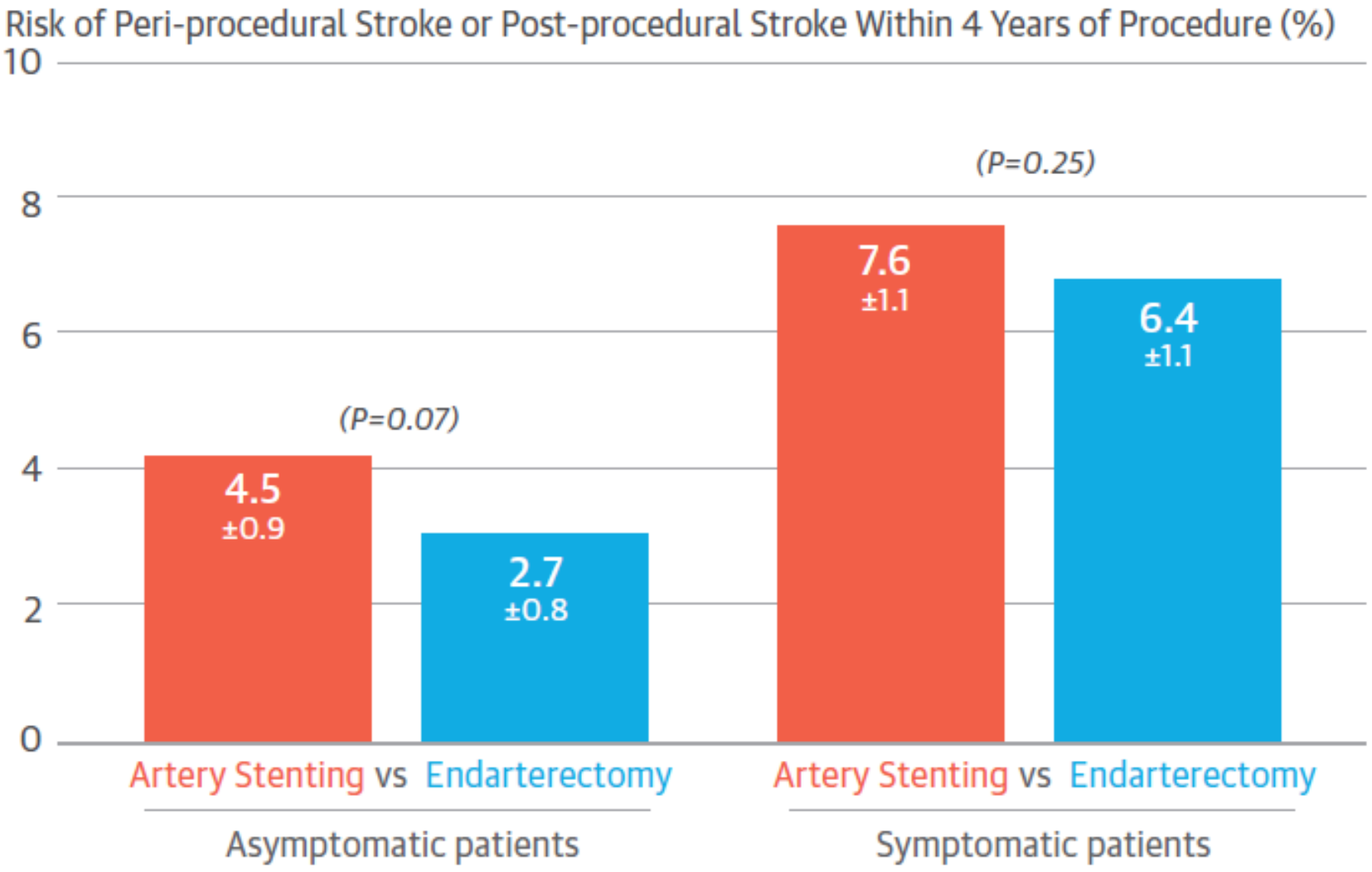
Comparing CAS and CEA Results in High Surgical Risk Symptomatic Patients



CAS Results show an improved trend in High surgical risk patients(2003-2012)



Comparing CAS and CEA Results in Low surgical Risk Patients



High Risk Features For CAS

Medical Co-morbidity	Anatomic Criteria	Procedural Factor
Elderly (>75/80 yrs)	Type III aortic arch	Inexperienced operator/ center
Symptom status	Vessel tortuosity	EPD not used
Bleeding risk/ hypercoagulable state	Heavy calcification	Lack of femoral access
Severe aortic stenosis	Lesion related thrombus	Time delay to perform procedure form onset of symptoms
Chronic kidney disease	Echolucent plaque	
Decreased cerebral reserve	Aortic arch atheroma	

2011 Guidelines for CAS

	ACCF/AHA (26)		ESC (25)	
	Class	Level	Class	Level
Symptomatic Standard risk	I	B	IIb	B
High risk	IIa or b[a]	B	IIa	B
Asymptomatic Standard risk	IIb	B	IIb	B
High risk	NA	NA	IIb	B

CAS. Current Practice

- Improvement in the equipment and stent technology has made CAS easier and quicker.
- Use of protection devices both distal and proximal have reduced the procedure related stroke and resulted in better outcome .
- Radial approach has enhanced the success rate in selected cases.esp; those with difficult aortic arch anatomy.

CAS- The challenge

ASYMTOMATIC
CAROTID ARTERY STENOSIS

CAS-Beyond the stenosis severity

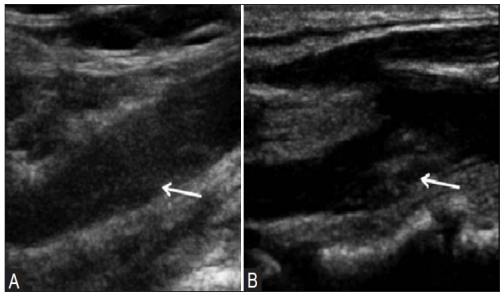
- Current guidelines recommend carotid revascularization based on stenosis severity.
- Weak correlation between stenosis severity and the stroke risk. Even low grade stenosis can lead to stroke.
- Uncertainty remains regarding stroke prevention potential of either CEA or CAS in asymptomatic pts.

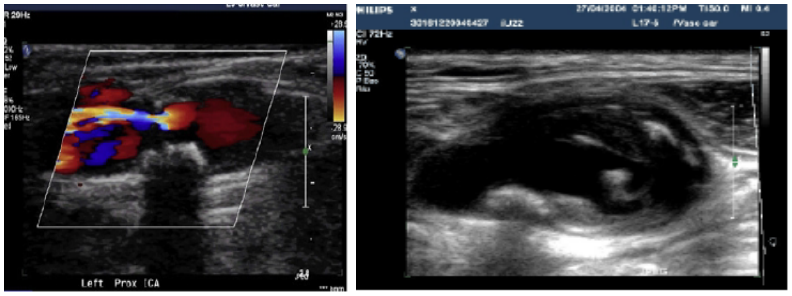
CAS- Going Beyond Stenosis Severity

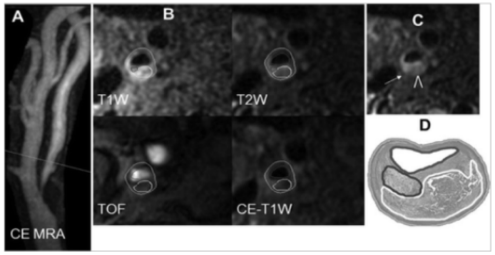
Clinical

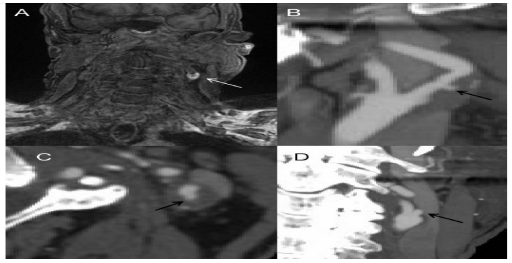
- Contralateral Occlusion
- H/o Contralateral stroke /TIA

Plaque Morphology (Imaging:Ultrasound, MRI)

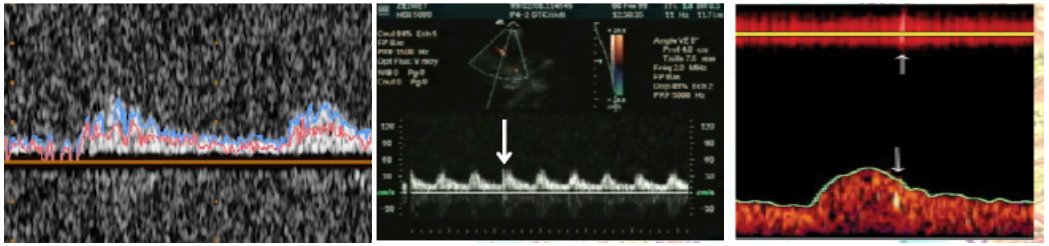


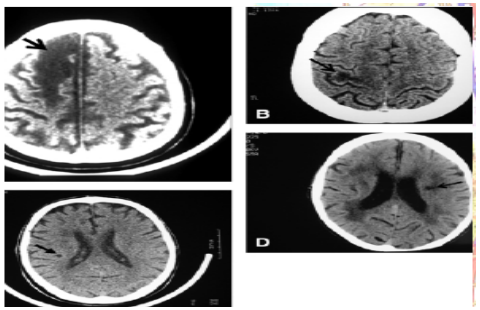






State of Cerebral Circulation(TCD)





Asymtomatic CAS

Who is likely to benefit from revascularization

Stenosis 60-90% + any one of the following

- **Contralateral Occlusion**
- **H/o Contralateral stroke /TIA**
- **Hypoechoic Irregular Plaque**
- **Progressive higher degree of stenosis**
- **Haemodynamic instability of cerebral circulation**
- **HITS at TCD**
- **Infarction at CT or MRI**

Conclusion

- **CAS and CEA have reached clinical equipoise as strategies for carotid revascularization.**

- **Selection of appropriate cases for each modality of revascularisation require through evaluation of the anatomical and clinical characteristics of the patients.**

- **Improvement in carotid stenting and neuroprotection techniques have mitigated the current limitations of carotid stenting.**

- **Challenge –Identify the appropriate asymptomatic patient for CAS. plaque characterization and cerebral effects of reduced flow, rate of progression of stenosis , all will emerge as important considerations.**

THANK YOU