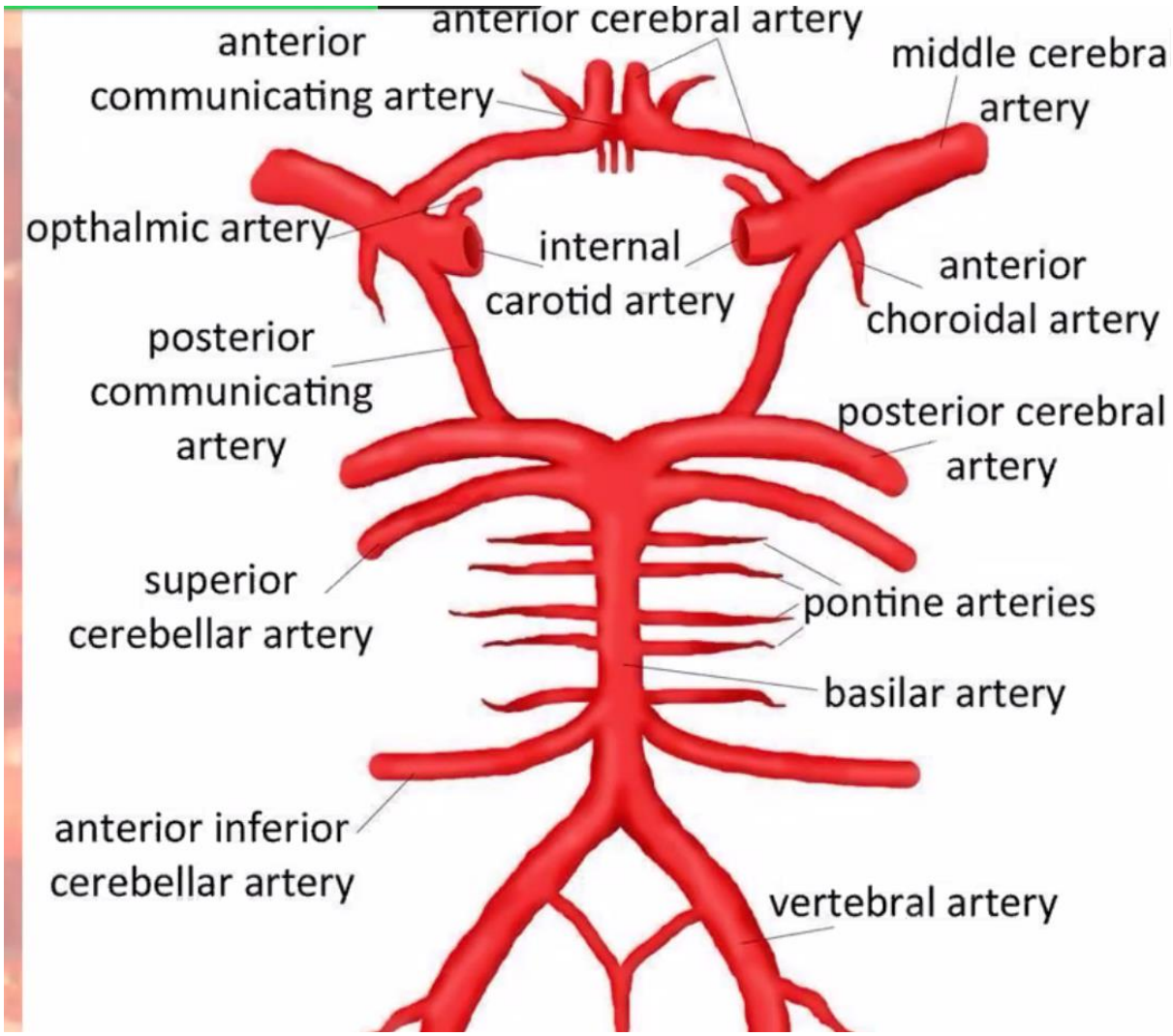
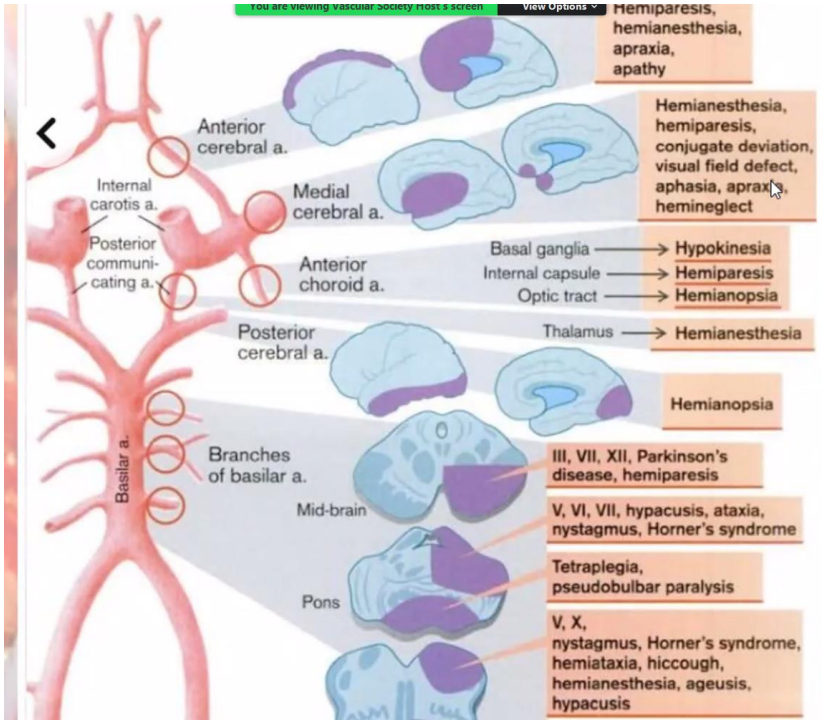
ASPIRE Junior: Vascular and Neurology

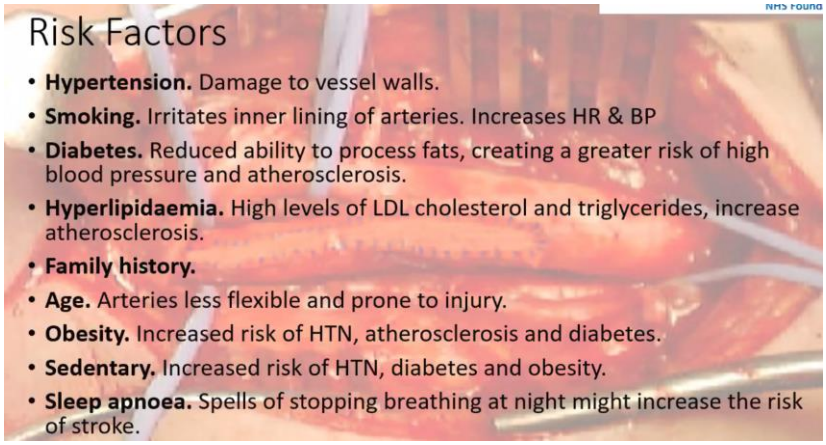
- Not much to do w/ neurology other than carotid endarterectomy
- Stroke 4th biggest killer in UK
- 2/3 leave hospital w/disability
- 152000 stokes in UK each year
- 1.2 million living w/after effects of stroke
- Cost £26 million /year
- 85% ischaemic – 30% cardiac embolism; 20% carotid disease
- 13% haemorrhagic

Circle of Willis



Stroke – FAST (Face Arms Speech Time)





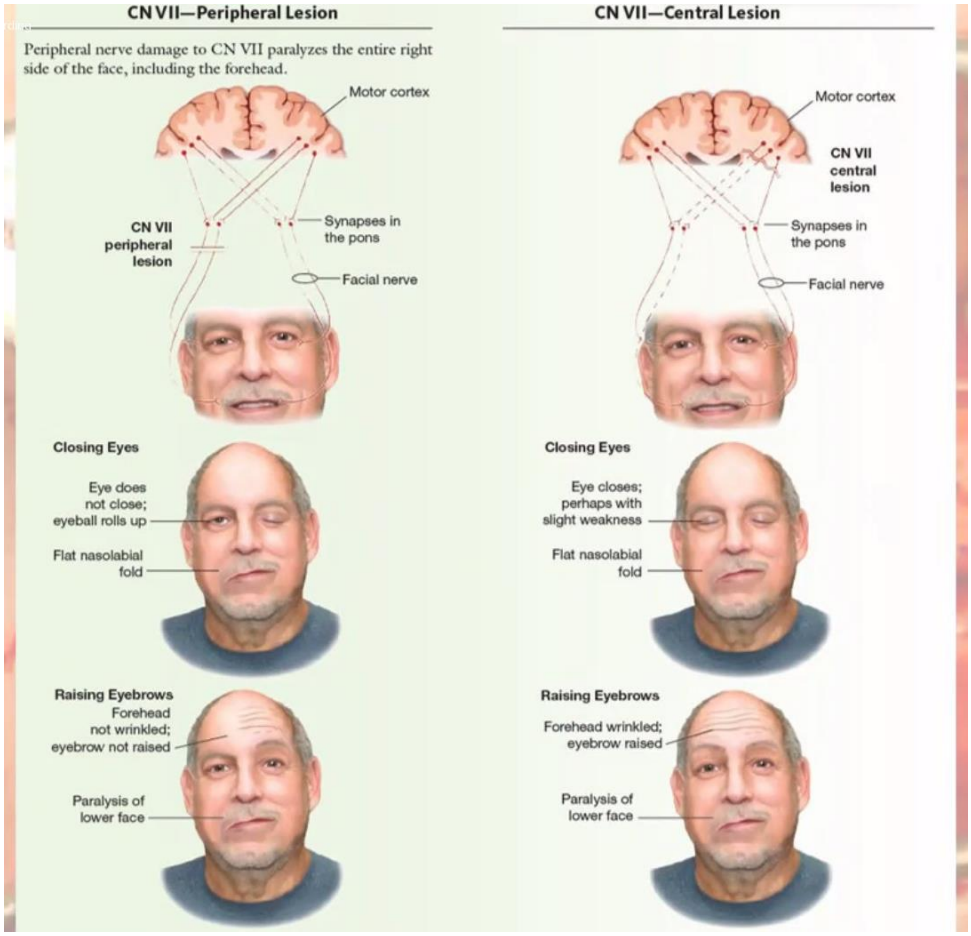
Counsel to stop smoking, take antiplatelets, etc

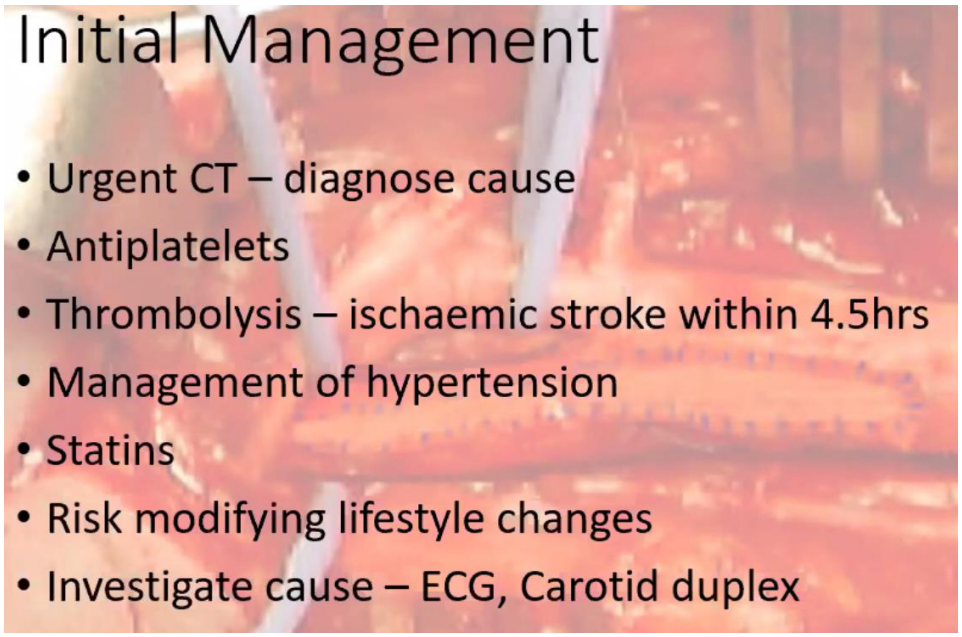
Atherosclerosis @ bifurcations d/t turbulence, wall stresses, etc

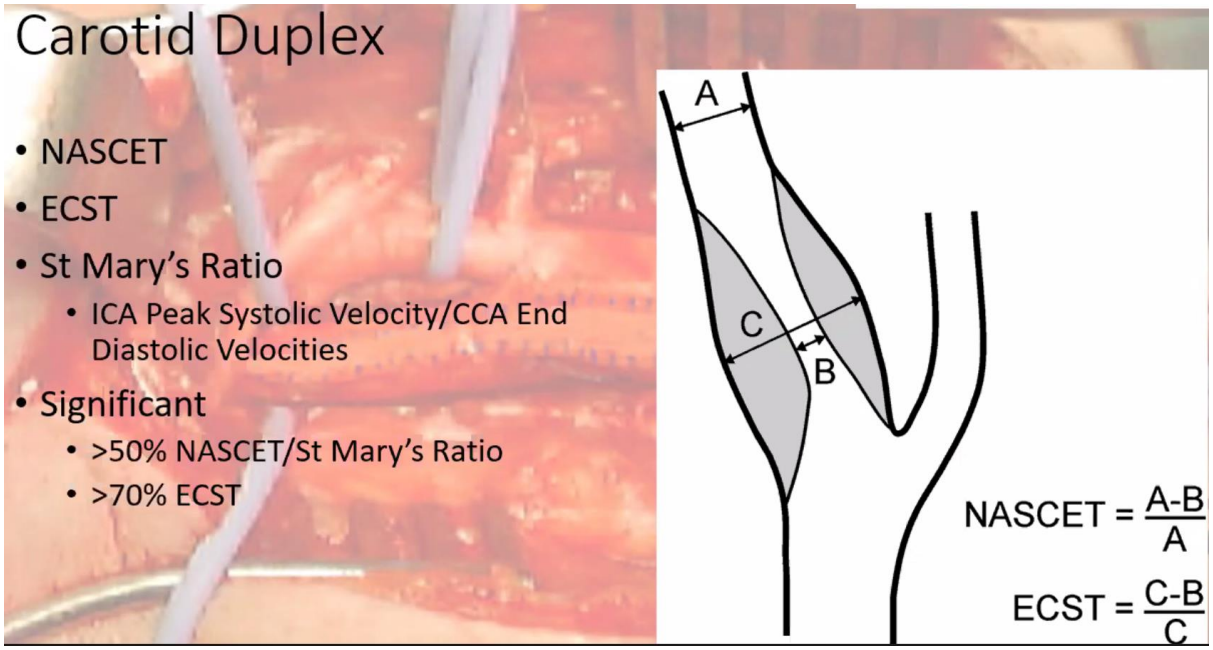
Amaurosis fugax – curtain over one eye

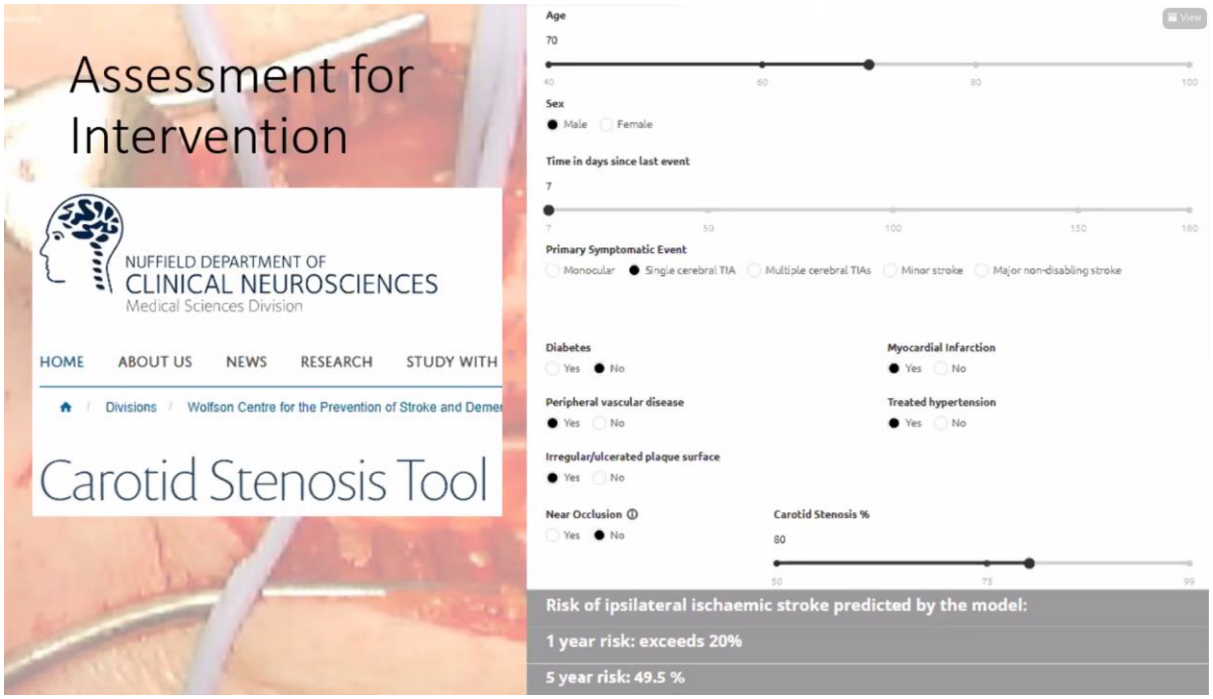
TIA – transient

CVA – True stroke









Risk v Benefit for surgical intervention

- Won't fix current symptoms
- Shown to decrease risk of stroke long term (50% decrease in subsequent stroke @ 1 r)
- Time critical – highest risk of stroke in immediate time period – 8% have CVA in 1 wk, 12% in 1 mth
- Intervene w/in 14 days
- Efficacy reduces with increased time
- Risks – stroke 1-2%, nerve injury 2%, return to theatre 5%

Carotid Endarterectomy

- Very vascular area, which heals quickly w/low infection rate
- Dissect on anterior aspect of sternomastoid

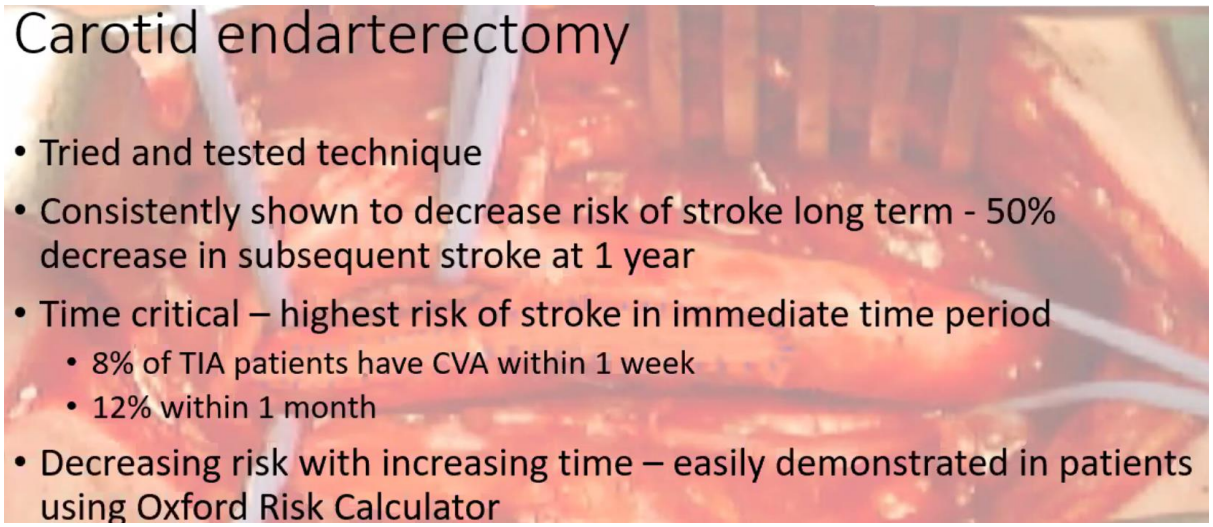
- Vagus nerve runs posteriorly between ICA and ECA
- Clamp above and below bifurcation
- Open vessel (arteriotomy), then insert shunt – need good view of a clear and clean ICA b4 inserting – shunting doesn't always have to be done – under local, can be done w/out but need anaesthesiologist who can monitor for cerebral ischemia.
- Make sure no atheroma left, especially on back wall – tack the intimal layer to the back wall to prevent dissection
- Patch – bovine pericardium or vein
- Likely to be turned down d/t prior surgery or radical neck dissection – consider stent

Complications

- Hypoglossal nerve damage – "crooked tongue" – tongue points away from injury – usually nerve bruising, which will recover w/time

Carotid stenting

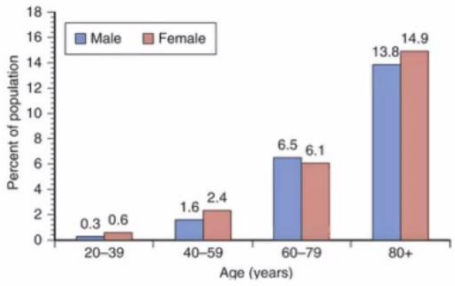
- Select units around UK – not common
- Pass guidewire through plaque, place embolic protection filter to decrease chance of stroke, balloon angioplasty, stent placement
- Needs careful patient selection



What is the evidence for intervention?

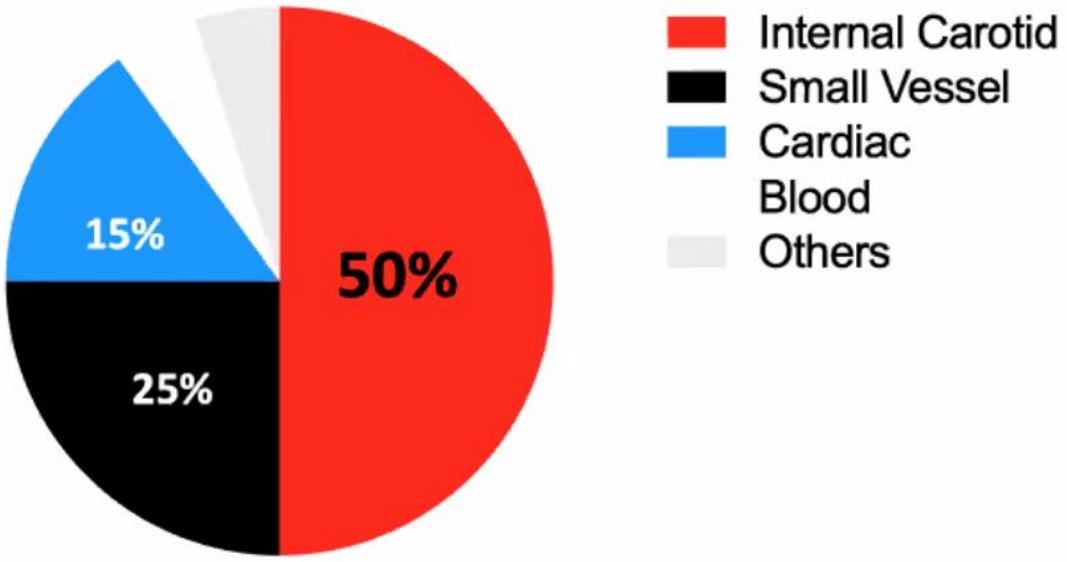
Stroke is

- Major cause of neurological disability
- 3rd most common cause of death
- UK Annual Incidence 2:1000 - about 15000/year
- 80% Ischaemic
- 20% Haemorrhagic



TIA is

- Acute loss of focal cerebral function with symptoms < 24hrs



Asymptomatic

- ✓ 4% of **ALL POPULATION** above 45yrs Do have bruit
- ✓ 60% of **90-99%** stenosis DON'T have bruit
- ✓ 30% of **TOTAL OCCLUSION** DO have bruit

BRUIT DOES NOT CORRELATE WITH SEVERITY OF OBSTRUCTION

Symptomatic

➢ **Classical Carotid Territory Symptoms:**

1. Hemi-motor/sensory signs
2. Monocular blindness (amaurosis fugax)
3. Higher cortical dysfunction (e.g., dysphasia)

Days after TIA event	Risk of Stroke
2 days	5-8%
7 days	8-22%
14 days	11-25%
5 years	21%

Any patient with a suspected:

✓ **acute TIA** > assessment in **<24hrs**

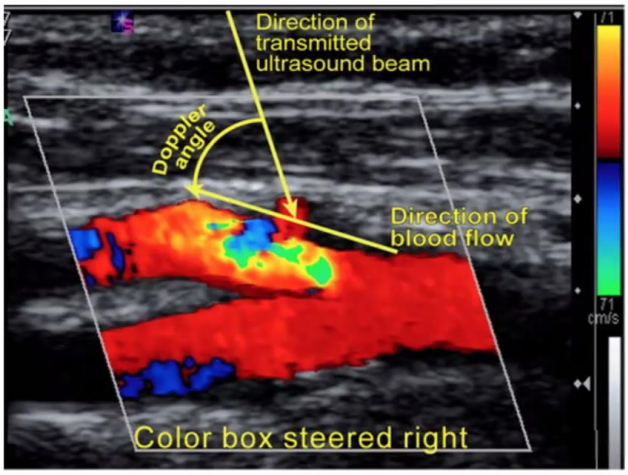
✓ **TIA >7 days** assessment in **within 7 days**

Pros:

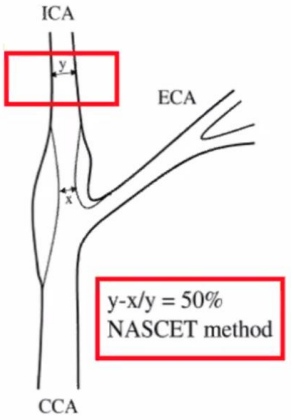
- Low cost
- Non invasive
- Flow dynamics

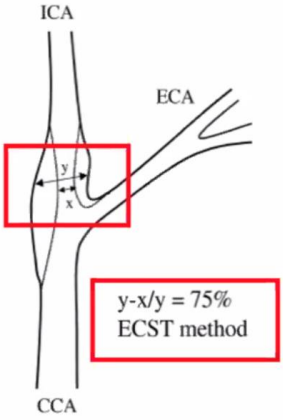
Cons:

- Operator dependent
- Cannot exclude intra-cranial ICA disease



US Carotid - NASCET vs ECST Stenosis Calculation





NASCET	ECST
30	65
40	70
50	75
60	80
70	85
80	91
90	97

Numerator = residual lumen diameter at level of stenosis at the tightest point
Denominator = NASCET – max diameter of artery at distal healthy point
ECST – max diameter of contour of carotid bulb artery at tightest point

Alhaddad, CCI, 2004

Carotid duplex used in the majority of cases, however is operator dependent, and may produce differing diagnoses – may need cross-sectional imaging – contrast enhanced MRA, CT carotid angiogram, Diagnostic angiogram (has a risk of stroke/death 1.5%) – ALL REQUIRE CONTRAST – angiogram is invasive

Carotid Artery Disease – Investigation (2)

Stenosis group	Imaging	Sensitivity % (95% CI)	Specificity % (95% CI)
70–99%	DUS	89% (0.85–0.92)	84% (0.77–0.89)
	CTA	77% (0.68–0.84)	95% (0.91–0.97)
	MRA	88% (0.82–0.92)	84% (0.76–0.90)
	CEMRA	94% (0.88–0.97)	93% (0.89–0.96)
50–69%	DUS	36% (0.25–0.49)	91% (0.87–0.94)
	CTA	67% (0.30–0.90)	79% (0.63–0.89)
	MRA	37% (0.26–0.49)	91% (0.78–0.97)
	CEMRA	77% (0.59–0.89)	97% (0.93–0.99)
<49%, 100%	DUS	83% (0.73–0.90)	84% (0.62–0.95)
	CTA	81% (0.70–0.88)	91% (0.74–0.98)
	MRA	81% (0.70–0.88)	88% (0.76–0.95)
	CEMRA	96% (0.90–0.99)	96% (0.90–0.99)

CEMRA had the highest sensitivity (94%), specificity (93%), followed by DUS (89%)

Carotid Artery Disease – Management

Best Medical Therapy

- Antiplatelets
- Lipid optimisation
- Antihypertensive
- DM management
- Smoking cessation

Intervention

- Carotid Artery Endarterectomy (CAE)
- Carotid Artery Stenting (CAS)

	Symptomatic*	Asymptomatic†
Blood pressure <140/90 mmHg	Class I, Level B	Class I, Level A
Statin therapy	Class I, Level A	Class I, Level C
Antiplatelet therapy	Class I, Level A	Class I, Level C

Blood Pressure Control

- ✓ Aim for BP < 140/90
- ✓ Every reduction of diastolic by 5% = RR reduction of stroke by 35%

However

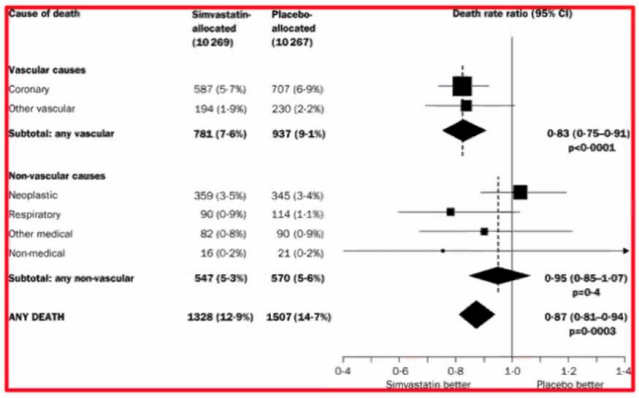
- Only 60% their BP is managed
- Only 50% their DBP < 90mmHg

Lipid Optimisation

The Heart Protection Study showed >>

Statins had 25% RR reduction of Stroke

Protecting 70-100/1000



Antiplatelet Therapy

Asymptomatic

- No RCTs on Antiplatelets among Asymptomatic Carotid Disease
- AHA guidelines recommend low dose Aspirin

Symptomatic

8 guidelines recommend:

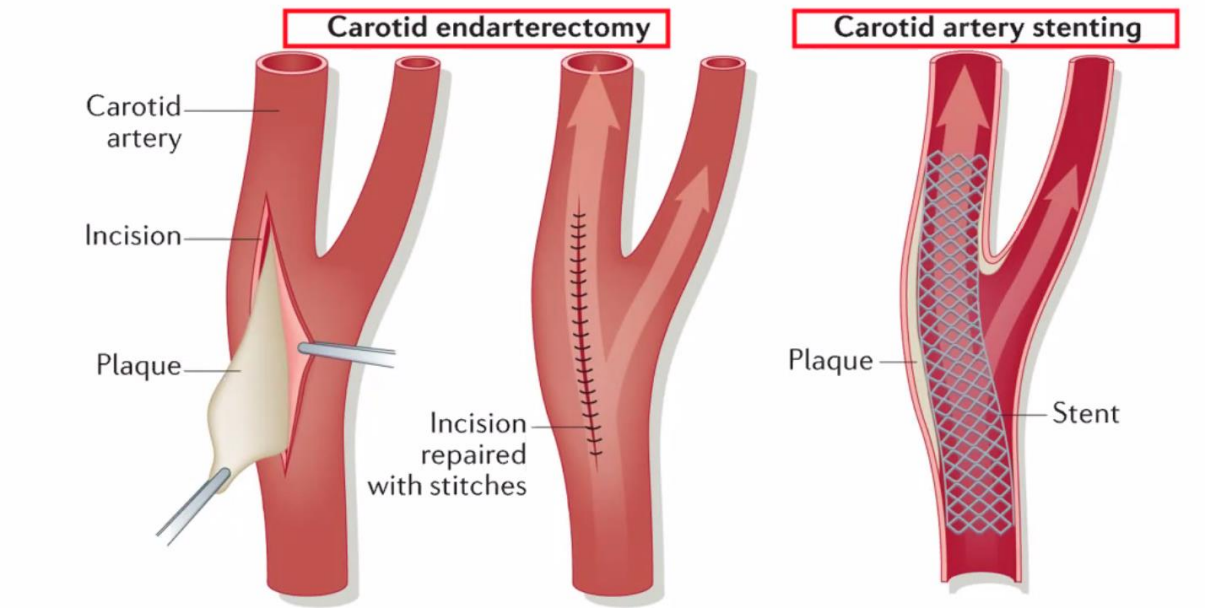
NO intervention

- Aspirin + Clopidogrel <24hrs from TIA onset
- Aspirin + Dipyridamole if intolerable to Clopidogrel

Intervention – variable

- ESVS 2023 Aspirin + Clopidogrel <24hrs from TIA onset
- Aspirin + Dipyridamole if intolerable to Clopidogrel

Carotid Artery Intervention



Asymptomatic carotid intervention – 41 studies – NO association with stenosis % and stroke risk

Intervention is better than BMT....however!

RCT	30-day death/ stroke after CEA	Ipsilateral stroke plus perioperative death or stroke		Stroke prevented by 1000 Patients	% of unnecessary interventions
		CEA	BMT	59 patients	94%
ACAS[19]	2.3%	5.1% at 5 years	11.0% at 5 years	53 patients	95%
ACST-1[51]	2.8%				
ACST-1[52]	2.8%			46 patients	95%

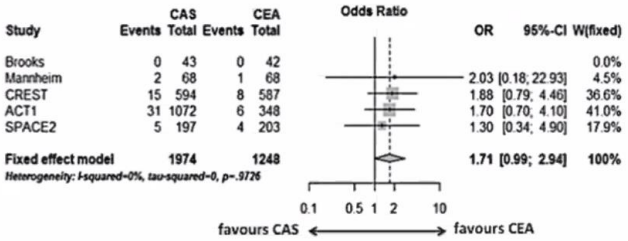
ESVS 2023 and AHA 2021 guidelines

Intervention should be considered in 'highly selected' average-risk patients with an asymptomatic > 70% stenosis

Carotid Endarterectomy vs Stenting

30-day outcomes	Lexington[95]		CREST-1[96]		ACT-1[97]		SPACE-2[80]			Mannheim[98]	
	CEA	CAS	CEA	CAS	CEA	CAS	CEA	CAS	BMT	CEA	CAS
	42	43	587	364	364	1089	203	197	113	68	68
Death/stroke	0%	0%	1.4%	2.5%	1.7%	2.9%	2.0%	2.5%	0.0%	1.5%	2.9%
Death/disabling stroke	0%	0%	0.3%	0.5%	0.6%	0.6%					
Death/stroke/MI	0%	0%	3.6%	3.5%	2.6%	3.3%				1.5%	2.9%

30-day Death/Stroke rate



CEA has lower risk of early stroke compared to CAS

Carotid disease & Cognition impartment

Stroke
Volume 52, Issue 12, December 2021; Pages 3855-3863
https://doi.org/10.1161/STROKEAHA.120.032972

CLINICAL AND POPULATION SCIENCES

Baseline Cognitive Impairment in Patients With Asymptomatic Carotid Stenosis in the CREST-2 Trial

Carotid and Supra-aortic Arteries

Eur J Vasc Endovasc Surg (2021) 61, 888–899

SYSTEMATIC REVIEW

Editor's Choice – Asymptomatic Carotid Stenosis and Cognitive Impairment: A Systematic Review

Severe carotid stenosis was associated with lower cognitive function

Does Carotid Intervention Improve Cognition?

Carotid and Supra-aortic Arteries

Eur J Vasc Endovasc Surg (2022) 63, 535–545

RANDOMISED CLINICAL TRIAL

Editor's Choice – Effect of Carotid Endarterectomy on 20 Year Incidence of Recorded Dementia: A Randomised Trial

	CEA	BMT
10-year rate of Dementia	6.7%	6.6%
20-year rate of Dementia	14.2%	15.5%

Carotid and Supra-aortic Arteries

Eur J Vasc Endovasc Surg (2021) 61, 888–899

SYSTEMATIC REVIEW

Editor's Choice – Asymptomatic Carotid Stenosis and Cognitive Impairment: A Systematic Review

ESVS 2023 – No CEA/CAS should be offered to improve cognition

Symptomatic Carotid Disease Intervention

Clinical Trial > Lancet. 1998 May 9;351(9113):1379-87.

Randomised trial of endarterectomy for recently symptomatic carotid stenosis: final results of the MRC European Carotid Surgery Trial (ECST)

Clinical Trial > N Engl J Med. 1998 Nov 12;339(20):1415-25.
doi: 10.1056/NEJM199811123392002.

Benefit of carotid endarterectomy in patients with symptomatic moderate or severe stenosis. North American Symptomatic Carotid Endarterectomy Trial Collaborators

Symptomatic Carotid Intervention – Which?

THE LANCET

Meta-Analysis > Lancet. 2004 Mar 20;363(9413):915-24.
doi: 10.1016/S0140-6736(04)15785-1.

Endarterectomy for symptomatic carotid stenosis in relation to clinical subgroups and timing of surgery

CEA for 50-99% NASCET stenosis in Symptomatic < 6 months

NASCET stenosis	*n*	30 days death/stroke after CEA	5-year risk		ARR in stroke at 5 years	RRR in stroke at 5 years	NNT	Strokes prevented per 1000 CEAs at 5 years
			CEA	BMT				
<30%	1746	No data	18.4%	15.7%	−2.7%	NB	NB	None at 5 yrs
30–49%	1429	6.7%	22.8%	25.5%	+2.7%	10%	37	27 at 5 yrs
50–69%	1549	8.4%	20.0%	27.8%	+7.8%	28%	13	78 at 5 yrs
70–99%	1095	6.2%	17.1%	32.7%	+15.6%	48%	6	156 at 5 yrs
Near occlusion	262	5.4%	22.4%	22.3%	−0.1%	NB	NB	None at 5 yrs

Symptomatic Carotid Intervention – When ?

	50–69% stenosis			70–99% stenosis		
	ARR	NNT	CVA/1000	ARR	NNT	CVA/1000
All patients						
<2 weeks	14.8%	7	148	23.0%	4	230
2–4 weeks	3.3%	30	33	15.9%	6	159
4–12 weeks	4.0%	25	40	7.9%	13	79
>12 weeks	–2.9%	NB	NB	7.4%	14	74
Females						
<2 weeks	13.8%	7	138	41.7%	2	417
2–4 weeks	–5.7%	NB	NB	6.6%	15	66
4–12 weeks	–2.2%	NB	NB	–2.2%	NB	NB
>12 weeks	–21.7%	NB	NB	–2.4%	NB	NB

Which patient to offer intervention? When?

High risk patients:

- ✓ Males
- ✓ >75years
- ✓ Hemispheric stroke
- ✓ Recurrent symptoms
- ✓ Symptoms <14 days
- ✓ Irregular plaques
- ✓ Echolucent plaques
- ✓ High stenosis
- ✓ Contralateral occlusion

Females:

- ✓ Symptomatic females should get surgery ASAP
- ✓ Delayed surgery = more risk + less benefit

Ulcerated an echolucent plaques are more risky

Endarterectomy vs Stenting

Review > Eur J Vasc Endovasc Surg. 2016 Jan;51(1):3-12. doi: 10.1016/j.ejvs.2015.07.032. Epub 2015 Sep 4.

Stroke/Death Rates Following Carotid Artery Stenting and Carotid Endarterectomy in Contemporary Administrative Dataset Registries: A Systematic Review

		CEA	CAS
Stroke/Death rate	< 7 days	2.8%	9.4%
	8-14 days	3.4%	8.1%

Carotid intervention registries on CAS death/stroke risk:

- 70% reported > 6% rate
- 20% reported > 10% rate

- Peri-operative period, CEA is associated with lower Stroke/Death risk
- After 30 days, CEA and CAS are comparable in durability and risk of ipsilateral stroke