The Challenges of Underwriting TIA and Carotid Artery Stenosis

WAHLU Underwriting Conference

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Northwestern Mutual®

Agenda:

- Identify characteristics of suspected vs. definite TIA
- Discuss the usual cerebrovascular imaging studies
- Provide an overview of carotid artery stenosis and key underwriting considerations
- Apply key risk assessment factors to case examples

Let's dive in with a case example…

A 55 year old male applying for insurance

His medical records reveal the following:

- Seen in the emergency department two years ago:
  - With acute onset of left arm weakness, unable to lift left arm off of lap
  - Symptoms improved on the way to the hospital, within 90 minutes

Case Example

- PMHx: Hypertension
  - Takes enalapril
- ROS:
  - No headache
  - No other neurologic symptoms
- Smoking Hx:
  - Smokes 1 ppd
- Physical Exam
  - 5'8" 220 lbs, in NAD
  - 160/90, HR 80, R 14
  - Right carotid bruit
  - Heart with regular rate and rhythm; No murmur
- Neuro exam – Normal except…
  - Sensory subjective decrease in pinprick in left upper extremity compared to the right

Case Example

Diagnostic studies done in the ER

- CT of head – normal
- EKG – normal sinus rhythm and no ischemic changes
- Echocardiogram at bedside – normal
- Blood work - normal

Case Example

Discharged home

- Told to follow up with PCP
- Meds: Daily baby ASA
- Smoking cessation information

DISCHARGE DIAGNOSIS

"?able TIA"

"Possible TIA"

"Rule out TIA"

What is a TIA?

TRANSIENT ISCHEMIC ATTACK

A brief episode of neurologic dysfunction caused by focal brain or retinal ischemia that meets the following criteria:

- Symptoms last less than 1 hour
- Without evidence of acute brain infarction

Definition from the 2009 Scientific Statement for Healthcare Professionals From the American Heart Association/American Stroke Association Stroke Council

What do we really need to know to underwrite the case example?

- **Suspected or Definite diagnosis**: Is there ever really a *definite* diagnosis?
- **Differential diagnosis**: Does the hx pass the smell test for a TIA or could it be something else?
- **The Workup**: What are all the body systems that need to be evaluated besides the nervous system?

What is the Risk of a TIA?

- 240,000 TIAs in the US per year
- 5-year stroke risk after TIA 29%
  - Hx of TIA and >70% carotid stenosis treated medically, 43.5% will have a stroke in 2 years
- Stroke following a prior TIA
  - Large artery atherothrombotic strokes - 25% - 50%
  - Cardioembolic strokes - 11% - 30%
  - Lacunar strokes - 11% to 14%

WHAT IS A TIA AND WHY IS IT NOT THAT SIMPLE...

- Diagnosis is made on history
- Initial head imaging studies are normal
- Symptoms may be vague - numb, dead, heavy, weak
- What else could it be?

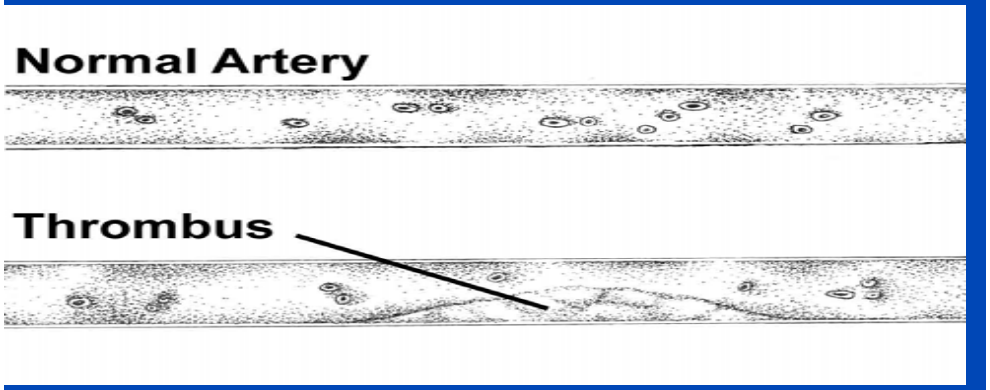
Causes of Cerebral Ischemia

Cause	Examples
Thrombus (Blood clot that forms in a blood vessel and does not move to another area of the body)	•Atherosclerosis i.e. carotid artery stenosis or total obstruction •Thrombosis secondary to arteritis, arterial dissection, vasospasm from drugs (such as cocaine), clotting disorder (hypercoaguable state), or hematologic disorder

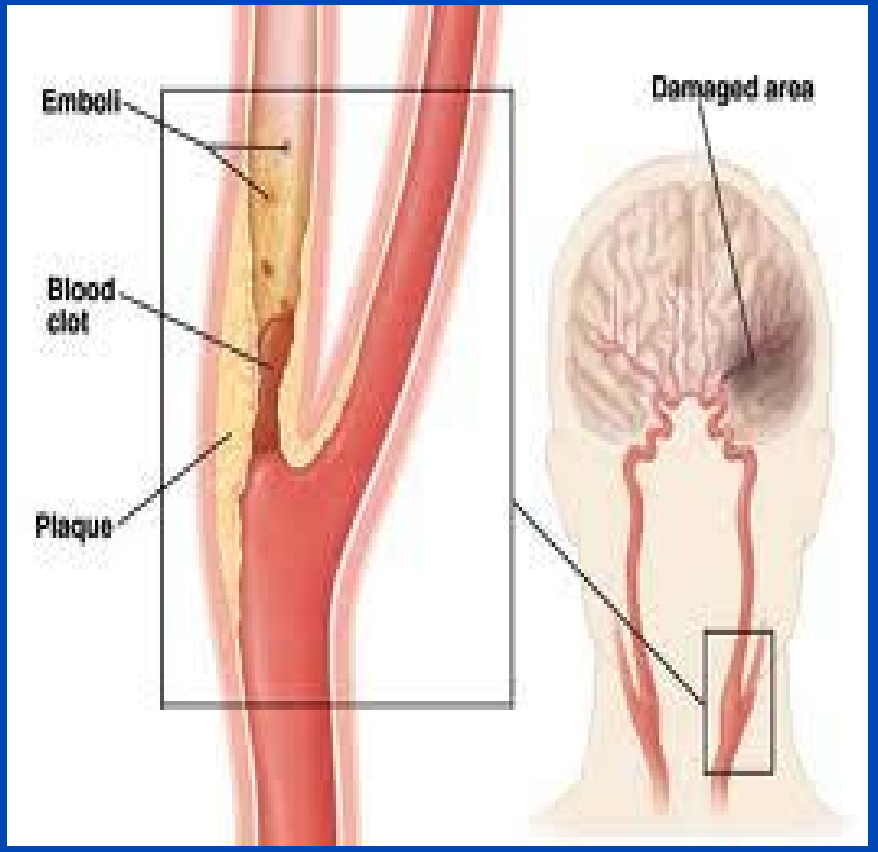
Causes of Cerebral Ischemia

Cause	Examples
Embolus (Blood clot/plaque or foreign body that forms in a blood vessel outside of the brain, breaks off, and travels to the brain)	•Oral contraceptive/estrogen supplement use •Unrepaired PFO/ASD •Atrial fibrillation or other irregular heart rhythms •Coronary artery disease •Valvular heart disease causing valvular vegetation •Large plaques found in the ascending aorta and carotid arteries •Serious illness (e.g., eclampsia, sepsis)

Causes of Cerebral Ischemia



Thrombus



Emboli from a thrombus

TIA Treatment
Antiplatelet vs. Anticoagulant

Atherothrombotic TIA: Daily long-term antiplatelet therapy

- Dipyridamole (persantine) plus aspirin
- Clopidogrel (plavix)
- Aspirin alone

Cardioembolic TIA: Long-term anticoagulation (Coumadin)

- If patient intolerant to anticoagulation, aspirin 325 mg daily
- Clopidogrel (plavix) 75 mg daily if intolerant to aspirin
- Pradaxa – atrial fibrillation

Rx can be clue

Risk Factors

Non-modifiable

- Older age > 60 yrs
- Male gender
- Heredity

Modifiable

- Hypertension
- Atrial fibrillation or other irregular heart beat
- Diabetes
- Smoking tobacco
- Excessive alcohol use
- Hypercholesterolemia
- Sedentary lifestyle

What should we look for when underwriting these histories?

- Onset
- Symptoms
  - Anatomical area involved
  - Accompanying symptoms
- Differential Diagnosis
- Workup

Onset of Symptoms - Abrupt

- Most last less than one hour
  - If TIA did not resolve within 1 hour, or rapidly improve over 3 hours, majority were stroke
- Symptoms occur in all affected areas at the same time
- Symptoms resolve gradually

SYMPTOMS - FOCAL VS. NON FOCAL

- Focal symptoms are caused by localized cerebral ischemia
- Non focal symptoms such as faintness, dizziness or generalized weakness are rarely due to focal cerebral ischemia

SYMPTOMS ARE "NEGATIVE"

- ✓loss of vision

- ✓loss of power

- ✓loss of sensation

Focal neurological symptoms (May be a TIA or stroke)

- Motor: Weakness, clumsiness, leaning to one side, ataxia or hemiparesis - one side of body.
- Speech/language: difficulty speaking, expressing, or understanding words, slurred speech.
- Sensory symptoms: abnormal feeling, feeling of heaviness
- Visual: Sudden loss of vision in one or both eyes, double vision or diplopia, amaurosis fugax

Non-focal neurological symptoms (Probably NOT a TIA or stroke)

- Generalized weakness and/or sensory disturbance.
- Light-headedness/Dizziness/Vertigo
- Faintness or near syncope
- Blackouts or syncope
- Incontinence of urine or feces
- Confusion
- Ringing in the ears or tinnitus

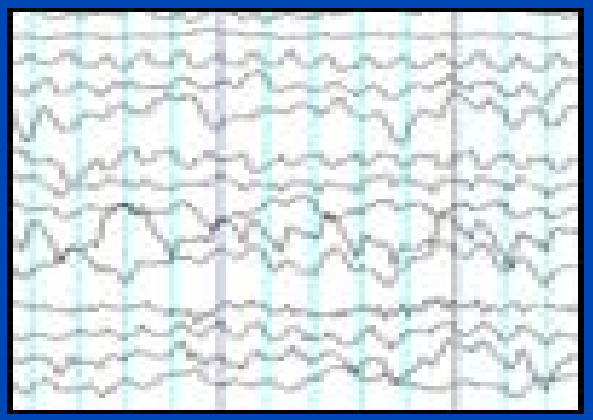
Differential Diagnosis

- Seizure
- Migraine with or without aura /hemiplegic migraine/Migraine equivalent
- Conversion Disorders
- Syncope/near syncope
- Structural intracranial lesions
- Vertigo
- Transient Global Amnesia
- Metabolic/toxic disorders
- Anxiety/Hyperventilation
- Multiple Sclerosis
- Motor neuron disease
- Mononeuropathy and radiculopathy
- Psychological disorders

Differential Diagnosis

Partial (focal) seizure

- Can mimic a TIA
- Positive sensory or motor symptoms i.e. tingling or jerking movements
- Spreads quickly (60 seconds)
- Negative symptoms afterward (Todd's paresis)
  Period of paralysis after the seizure
- Multiple attacks



WHAT IS HAPPENING TO THIS YOUNG HEALTHY WOMAN?

http://www.cbsnews.com/video/watch/?id=7357112n

Differential Diagnosis

Migraine with aura

An aura is a neurologic abnormality that may or may not precede a headache.

- Visual disturbances most common
- Positive visual symptoms
  - flashing lights
  - zigzag lines
  - colorful patterns
- Repetitive with similar visual symptoms with each occurrence
- Develops gradually over 5-20 minutes
- Symptoms march over several minutes
- Usually younger persons - headache within 1 hour*

**New headache pattern in persons > 50 yrs of age*


OPTICAL MIGRAINE

Differential Diagnosis

- Aura without Headache/Acephalgic Migraine
  - May not have hx of migraines
  - 98% Visual symptoms
  - 30% with other symptoms
    - 26% sensory
    - 16% aphasia
    - 6% dysarthria
    - 10% weakness
  - Mean age 48.7 (vs. 62.1)
  - Slow onset, spread and intensification of symptoms

SO, WHAT IS HAPPENING TO THIS YOUNG HEALTHY WOMAN?

http://www.cbsnews.com/video/watch/?id=7357112n

Differential Diagnosis

Conversion Disorders

- When individuals suffer neurological symptoms, such as numbness, blindness, or paralysis but without a neurological cause
- Symptoms cannot be explained by conventional medical disease.
- Examples: Functional disorders, Hyperventilation and anxiety

The Workup

Head Imaging studies

- CT or MRI
- Infarct vs. bleed vs. ischemia

EKG

- Atrial fibrillation or irregular rhythm
- Coronary Ischemia

Echocardiogram

- Structural or congenital heart disease
- Valve vegetations, PFO, ASD

The Workup

Lab tests

- Dehydration
- Anemia
- Hypoglycemia
- Infection

Carotid Ultrasound

- Stenosis in the arteries that lead to the brain
- Carotids, vertebrals

Head Imaging Study
CT Scan

- Usually first line head imaging study with presentation to the ER.
- Tells whether there is a new or old cerebral infarct
- Bleed shows up immediately/Infarct does not
- Does not show cerebral ischemia (TIA)

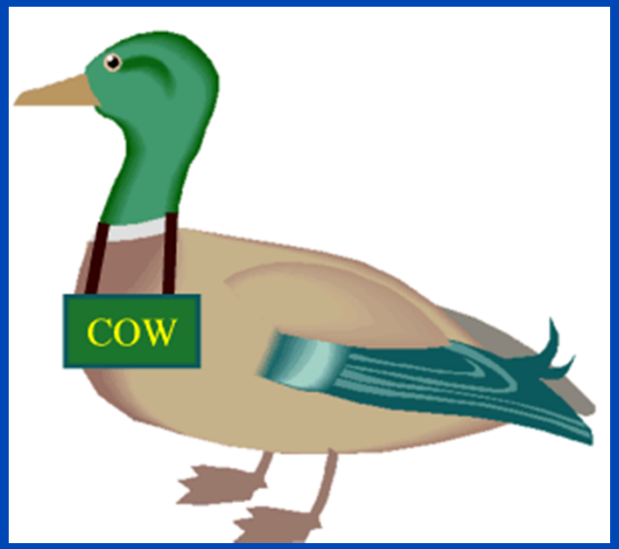
Head Imaging Studies MRI/MRA

- More sensitive than standard CT in identifying both new and preexisting ischemic lesions in TIA patients
- Diffusion Weighted imaging – even more precise
- DWI is more precise in the evaluation of ischemic insult in TIA patients compared with standard CT and MRI studies
- DWI (+) lesions tend to be smaller in TIA patients than in stroke.

Underwriting Transient Ischemic Attack

- ✓ Onset — Abrupt
- ✓ Symptoms — Focal
- ✓ Offset — Gradual
- ✓ Physical exam — BP, murmur, bruit, neuro s/s
- ✓ Past medical hx — Differential Diagnosis
- ✓ Current meds — Red Flag meds
- ✓ Head imaging studies /Workup — Cerebral ischemia vs cerebral infarct

"*If it looks like a duck*, walks like a *duck, and quacks like a duck*, it's probably a duck."



No matter what the "label" or diagnosis

ABCD^2 Score

- Can predict stroke risk after TIA
- BUT can be a tool for identifying a TIA
- The ABCD2 score is calculated by summing up points for five independent factors

Risk Factor	Points	Score
Age ≥ 60 years	**1**	
BP Syst BP ≥ 140 mmHg *OR* Diast BP ≥ 90 mmHg	**1**	
Clinical Features of TIA (choose one) Unilateral weakness with or without speech impairment OR Speech impairment without unilateral weakness	 **2** **1**	
Duration TIA duration ≥ 60 minutes TIA duration 10-59 minutes	 **2** **1**	
Diabetes	**1**	
Total ABCD2 score		

ABCD2 Score	2-day Stroke Risk	Comment
0-3	1.0%	Hospital observation may be unnecessary without another indication (e.g. new Afib)
4-5	4.1%	Hospital observation justified in most situations
6-7	8.1%	Hospital observation worthwhile

Johnston SC, Rothwell PM, Huynh-Huynh MN, Giles MF, Elkins JS, Sidney S, "Validation and refinement of scores to predict very early stroke risk after transient ischemic attack," Lancet, 369:283-292, 2007.

REMEMBER OUR CASE EXAMPLE…

A 55 year old male

Two years ago with acute onset of

- Left arm weakness: Motor weakness
- Symptoms improved within 90 minutes
- Hypertension on Rx – BP on exam 160/90

Risk Factor	Points	Score
Age ≥ 60 years	1	0
BP Syst BP ≥ 140 mmHg *OR* Diast BP ≥ 90 mmHg	1	1
Clinical Features of TIA (choose one) Unilateral weakness with or without speech impairment OR Speech impairment without unilateral weakness	 2 1	 2 0
Duration TIA duration ≥ 60 minutes TIA duration 10-59 minutes	 2 1	 2 0
Diabetes	1	0
Total ABCD2 score		5

MORE LIKELY OR LESS LIKELY A TIA??

ABCD2 Score	2-day Stroke Risk
0-3	Low
4-5	Intermediate
6-7	High

Risk Factor	Points	Score
Age ≥ 60 years	1	0
BP Syst BP ≥ 140 mmHg *OR* Diast BP ≥ 90 mmHg	1	1
Clinical Features of TIA (choose one) Unilateral weakness with or without speech impairment OR Speech impairment without unilateral weakness	 2 1	 2 0
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MORE LIKELY OR LESS LIKELY A TIA??

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Diabetes	1	0
Total ABCD2 score		5

Remember our case example…

55 year old male presented to the ER 2 years ago with acute onset of left arm weakness

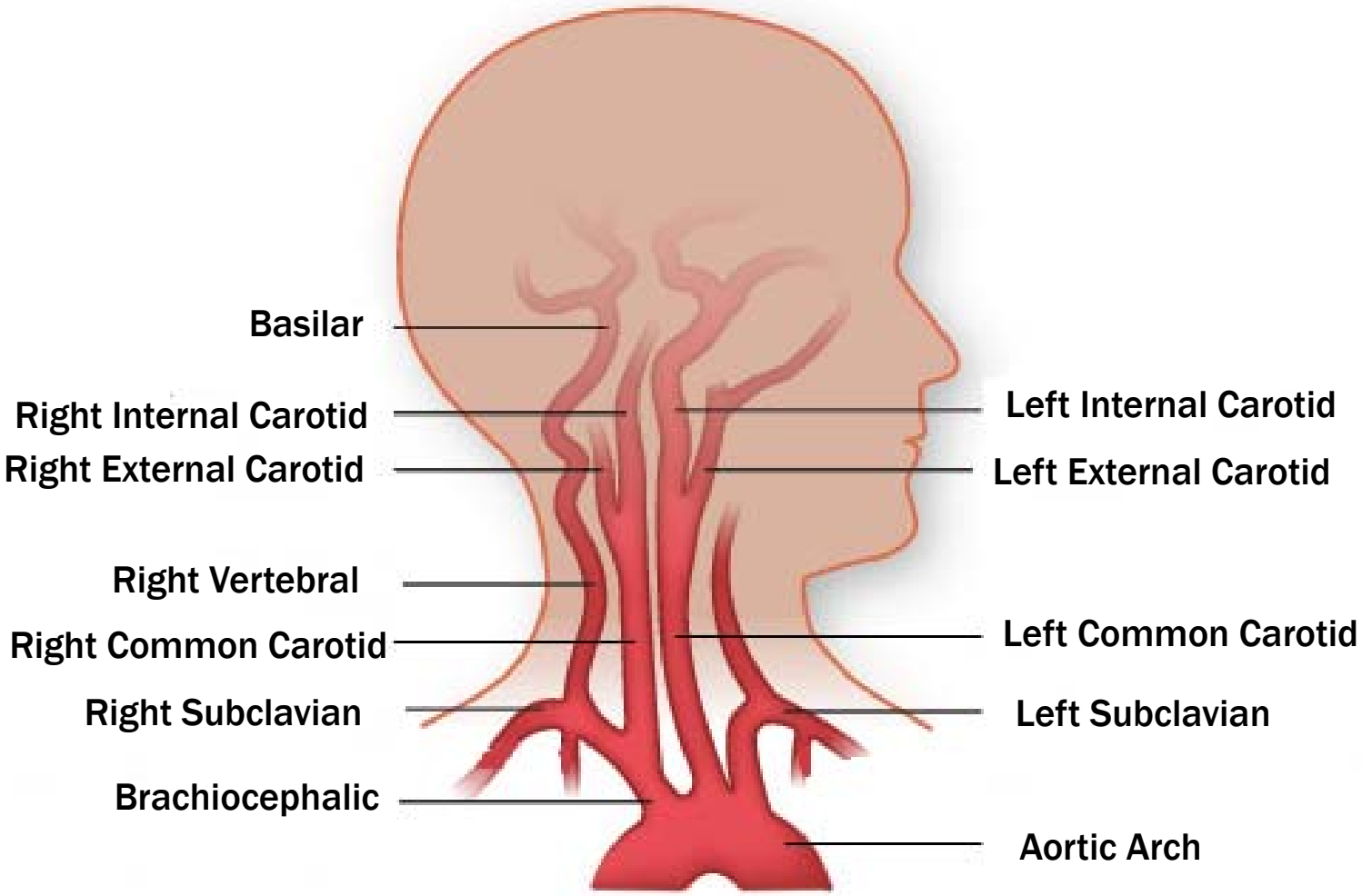
- Focal symptoms lasted 90 minutes
- Risk factors: Age 55, HTN on tx, BP 160/90, Tobacco use
- CT, echocardiogram and EKG nl
- Right carotid bruit on exam

Carotid Artery Bruit

- Carotid stenosis may be present
  - Sensitivity is low (11-51%)
- A carotid imaging study is recommended to evaluate
- A marker for generalized atherosclerosis elsewhere in body

- Twice as likely to die of MI or other cardiovascular disease compared to those without a bruit

Anatomy


Basilar
Right Internal Carotid
Right External Carotid
Right Vertebral
Right Common Carotid
Right Subclavian
Brachiocephalic
Left Internal Carotid
Left External Carotid
Left Common Carotid
Left Subclavian
Aortic Arch

Carotid Stenosis – What is the Risk?

Accounts for 15 to 20% of all ischemic Strokes

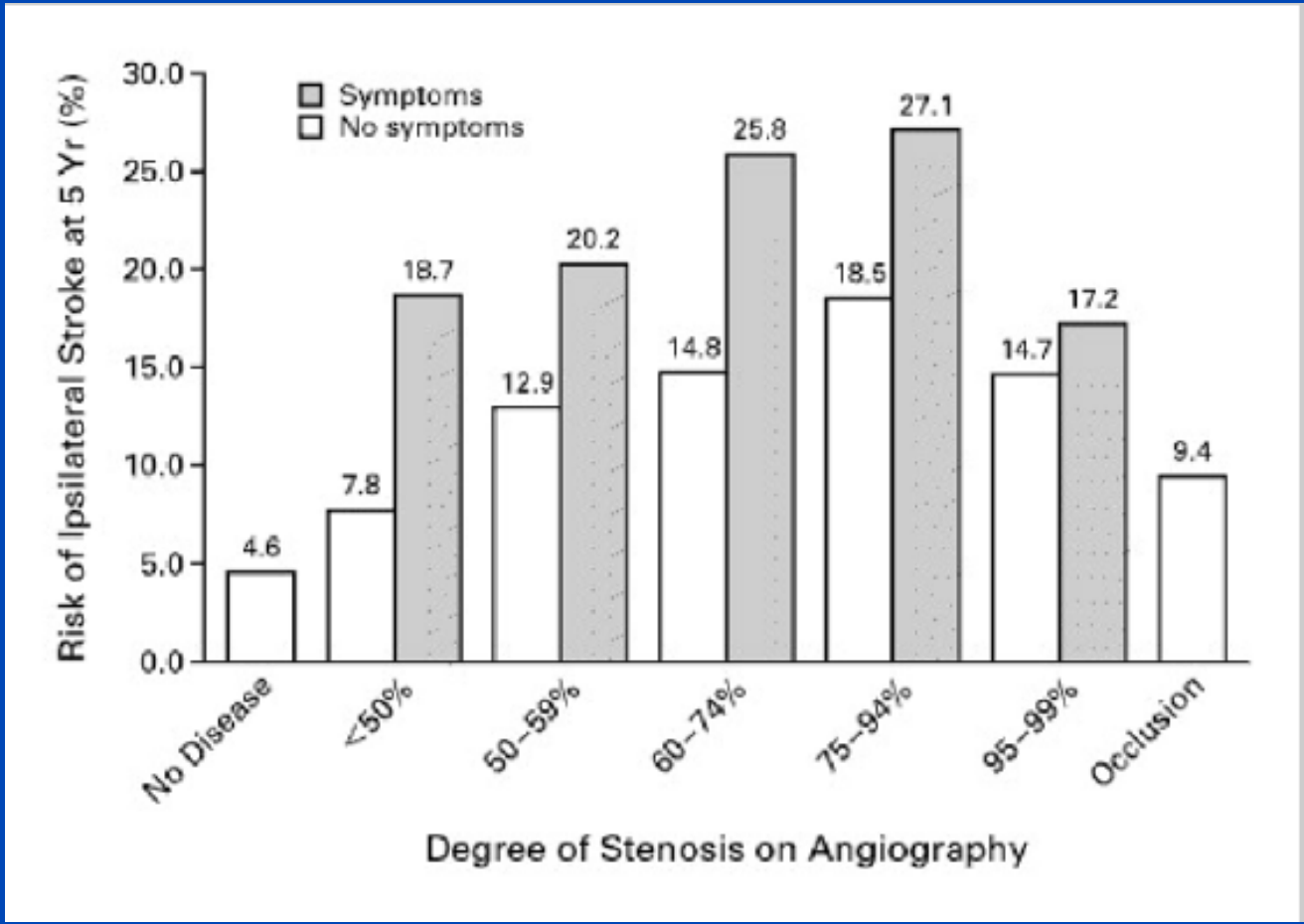
- Stroke is the 4th leading cause of death & a leading cause of long-term disability

Frequent cause of TIA

- 5-year stroke risk after TIA is 29%
- If TIA with >70% carotid stenosis treated medically, 43.5% will have a stroke in 2 years

Usual cause of death is related to MI related to cardiovascular disease

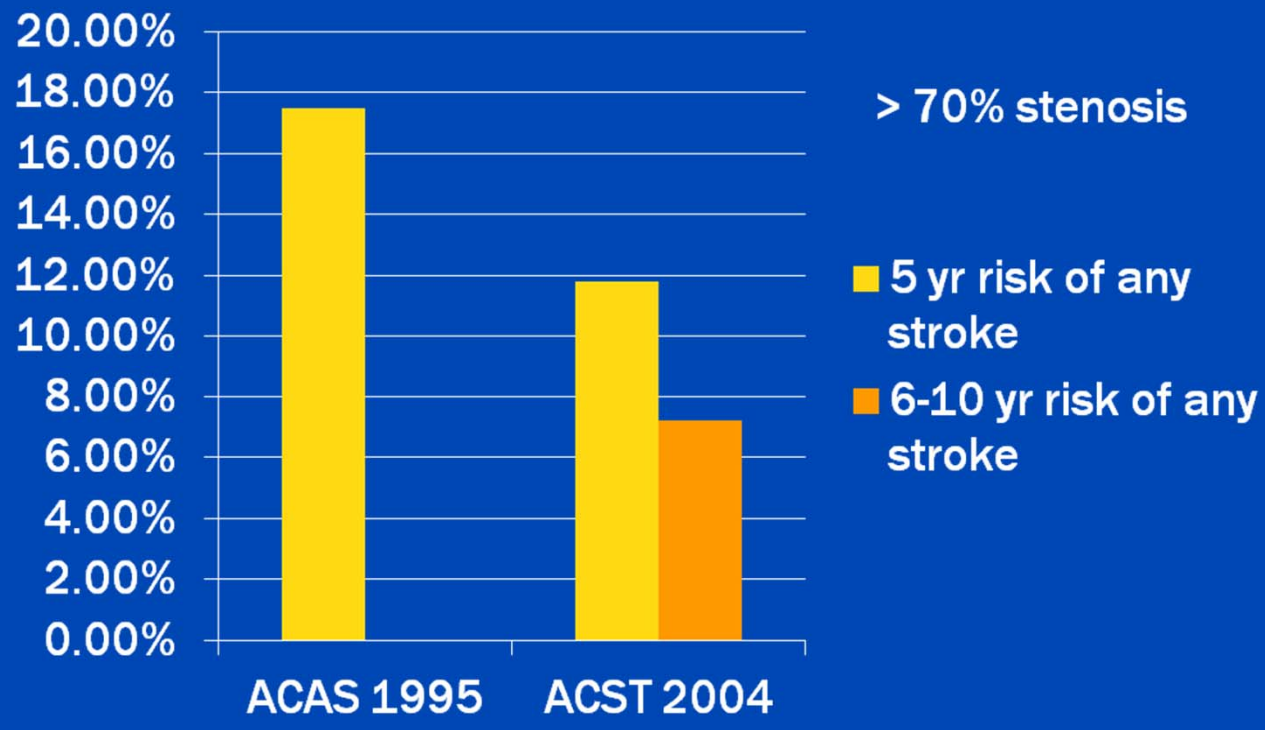
5 Year Risk of Stroke with Carotid Stenosis, with & without symptoms



The Causes and Risk of Stroke in Patients with Asymptomatic Internal-Carotid-Artery Stenosis. Domenico Inzitari, M.D. et. al. for the North American Symptomatic Carotid Endarterectomy Trial Collaborators N Engl J Med 2000; 342:1693-1701 June 8, 2000

Good News

- Risk of stroke in asymptomatic carotid stenosis treated medically is improving
- Use of statins & improved BP meds & control



ACAS – Asymptomatic Carotid Artery Study; ACST – Asymptomatic Carotid Surgery Trial
What Is the Current Status of Invasive Treatment of Extracranial Carotid Artery Disease? Naylor MD, FRCS Stroke 2011:42:2080-2085

Carotid Stenosis
Key Underwriting Considerations

- Underlying cause
- Presence of cardiovascular risk factors
- Whether symptomatic or asymptomatic
- Severity of Stenosis – Imaging Studies
- Treatment
- Interim history and follow-up

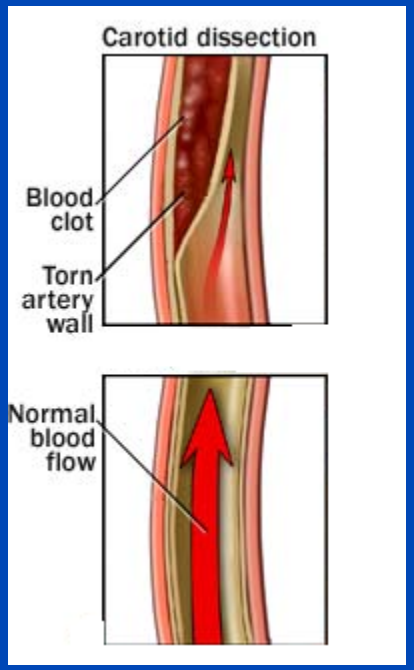
Key Underwriting Considerations: Causes of Carotid Stenosis

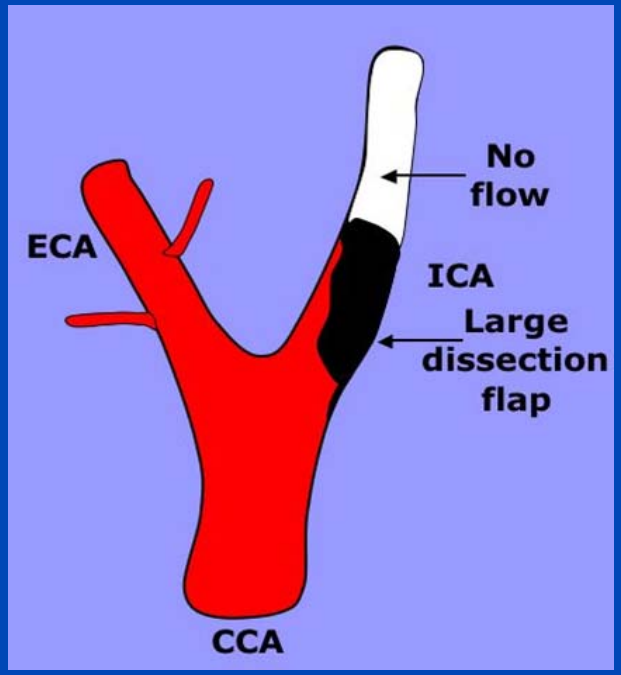
Atherosclerosis - most common

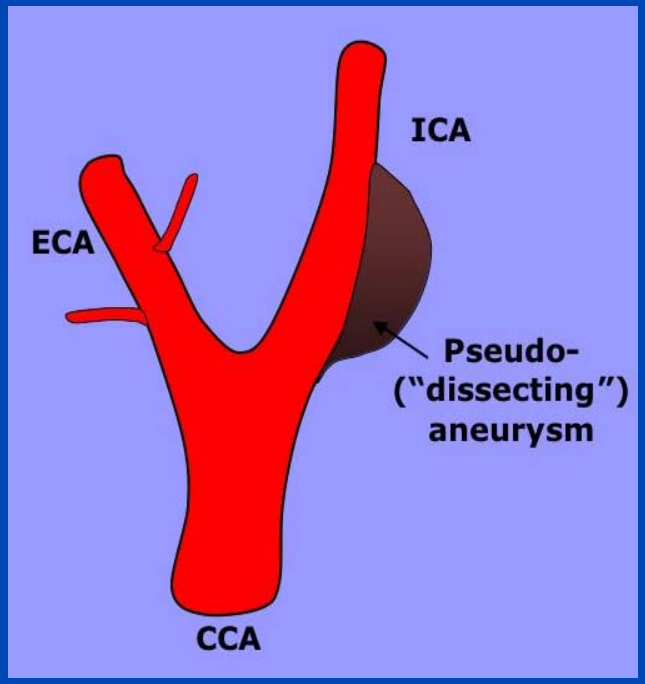
Other causes - infrequent

- Fibromuscular dysplasia (FMD)
- Carotid or Vertebral Dissection

Carotid Artery Dissection

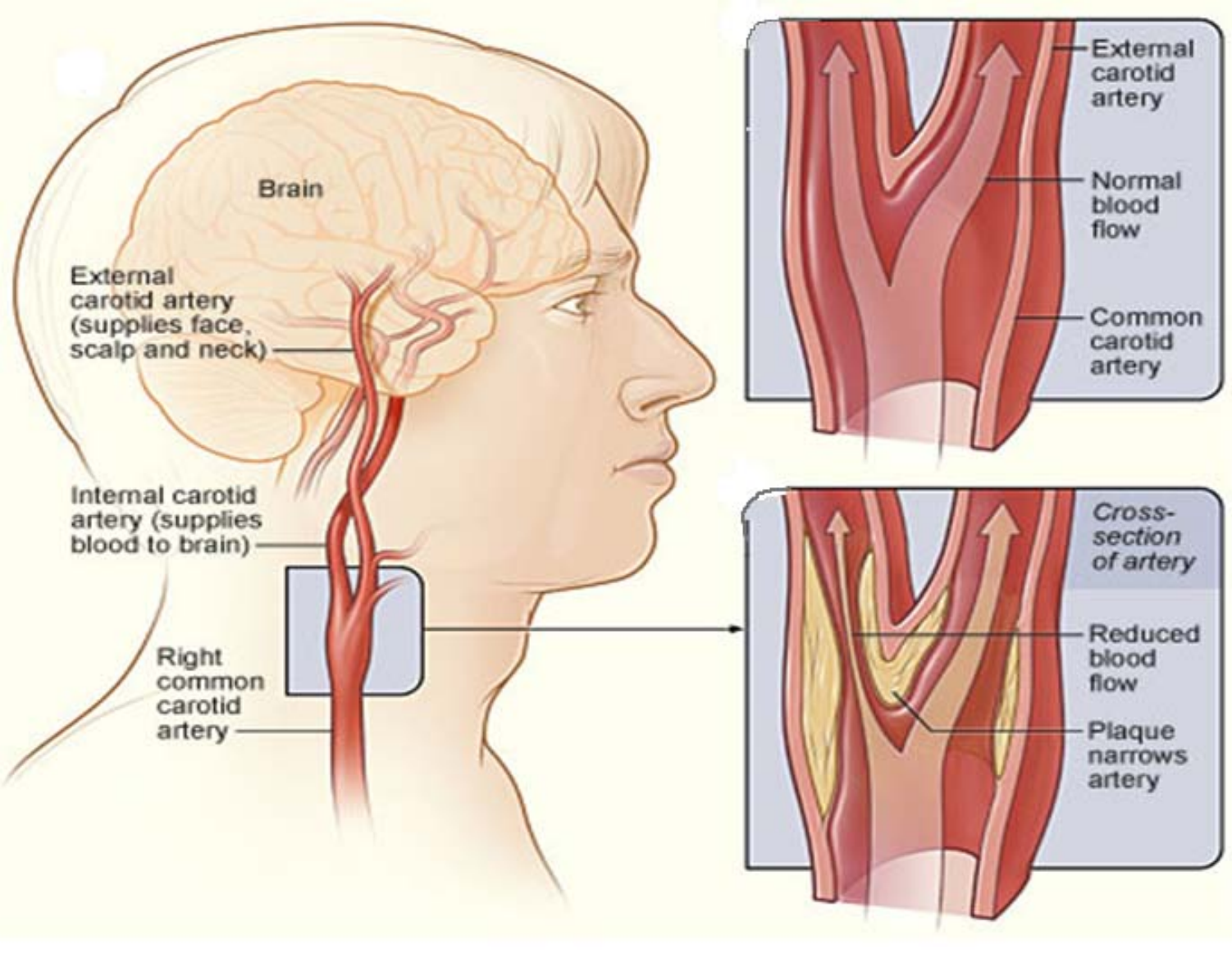






- Usually due to trauma, sudden neck movement, fibromuscular dysplasia, or unknown cause
- Mortality and morbidity are related to underlying cause, risk of recurrence & residual deficits

Carotid Artery Atherosclerosis



Key Underwriting Considerations: CV Risk Factors

- Hypertension – BP> 140/90 mmHg
- Tobacco Use
- Hyperlipidemia
- Diabetes
- Age at onset – younger ages have increased risk if caused by atherosclerosis

Key Underwriting Considerations: Symptomatic vs. Asymptomatic

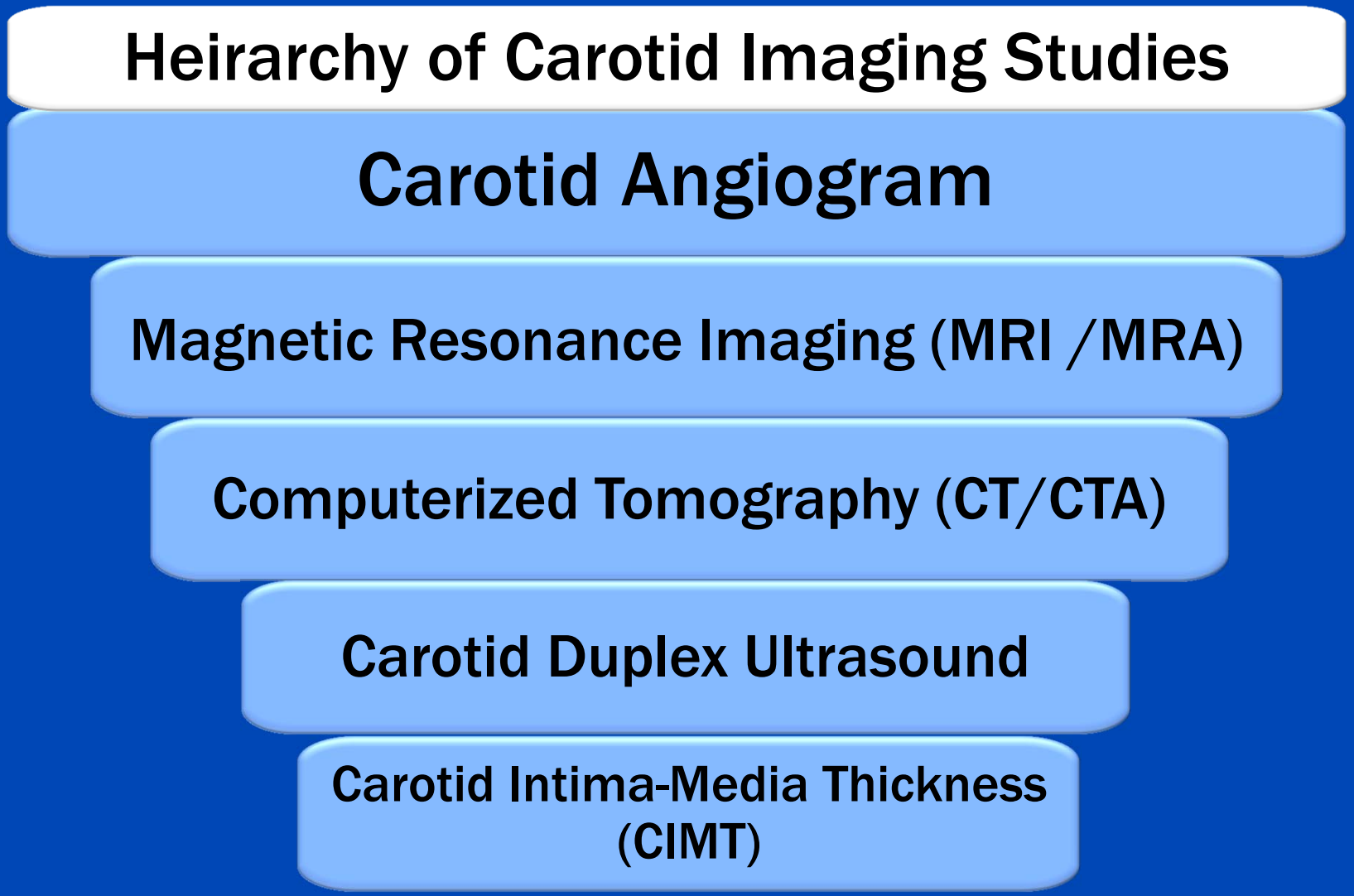
Symptomatic

- TIA or stroke
- Dizziness & syncope are not usual symptoms

Asymptomatic

- Discovered on screening carotid study
- Carotid bruit

Key Underwriting Considerations: Severity of Stenosis



The Challenge of Underwriting Carotid Imaging Studies

- Descriptions on reports are vague
- Stenosis is provided in a wide range
- It's difficult to determine if study is normal or abnormal
- There are often several reports with variable findings

Underwriting Carotid Imaging Studies

Questions to consider:

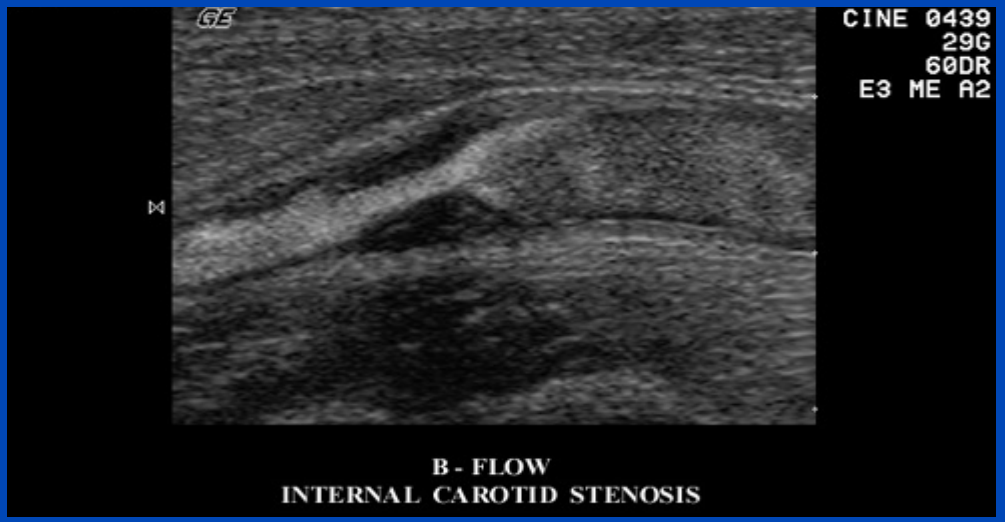
- Why was study done?
- What type of study?
- Is there plaque or stenosis?
  - Look closely at body of report and final conclusion
  - What is the severity? Is it unilateral or bilateral?

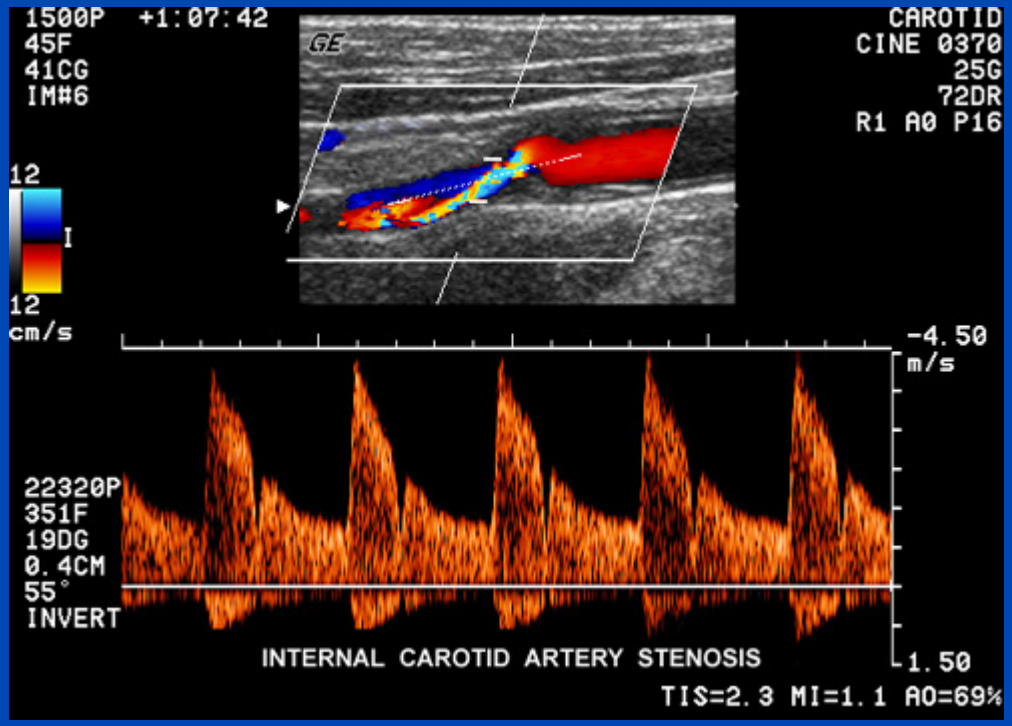
...then LOOK at the other key underwriting considerations

Carotid Duplex Ultrasound

- Initial study to evaluate TIA, stroke, carotid bruit, or for screening
- Noninvasive, painless, & inexpensive
- Accurate for diagnosing >50% stenosis (Sensitivity 89%, Specificity 83%)
- Identifies stenosis, plaque & intimal thickening based on:
  - Visual inspection of ultrasound images
  - Blood flow velocity measurements obtained with Doppler (detects turbulence)

Carotid Duplex US Images





Key Underwriting Considerations: Severity of Carotid Stenosis

% Stenosis	Description
0%	Normal
1 – 49%	Plaque or intimal thickening Minimal, mild, mild-to-moderate
50 – 69%	Moderate 
70 – 95%	Severe 
100%	Complete occlusion

2011 Guidelines on the Management of Patients With Extracranial Carotid and Vertebral Artery Disease, AHA, ASA, et al *Circulation. 2011;124:e54-e130*

Carotid Duplex Ultrasound

Blood Flow Velocity Measurements

% Stenosis	ICA PSV* Most reliable	ICA/CCA PSV ratio	ICA EDV
None 1-49%	< 125 cm/sec	< 2.0	< 40 cm/sec
50% to 69%	125 to 230 cm/sec	2.0 to 4.0	40 to 100 cm/sec
70% to 99%	> 230 cm/sec	> 4.0	> 100 cm/sec
100%	No signal	No signal	No signal

ICA- internal carotid artery; PSV-peak systolic velocity; CCA-common carotid artery; EDV-end diastolic velocity

2011 Guidelines on the Management of Patients With Extracranial Carotid and Vertebral Artery Disease, AHA, ASA, et al *Circulation. 2011;124:e54-e130*

Example of Carotid Duplex US

DIAGNOSIS: T.I.A.
DATE OF EXAMINATION: July 13, 2010
TECHNOLOGIST:

CAROTID DUPLEX ULTRASOUND

VESSEL	RIGHT (cm/sec)	LEFT (cm/sec)
CCA Peak systolic velocity	94	97
ICA Peak systolic velocity	57	85
ICA End diastolic velocity	20	28
ECA Peak systolic velocity	80	60
ICA/CCA RATIO:	0.6	0.9

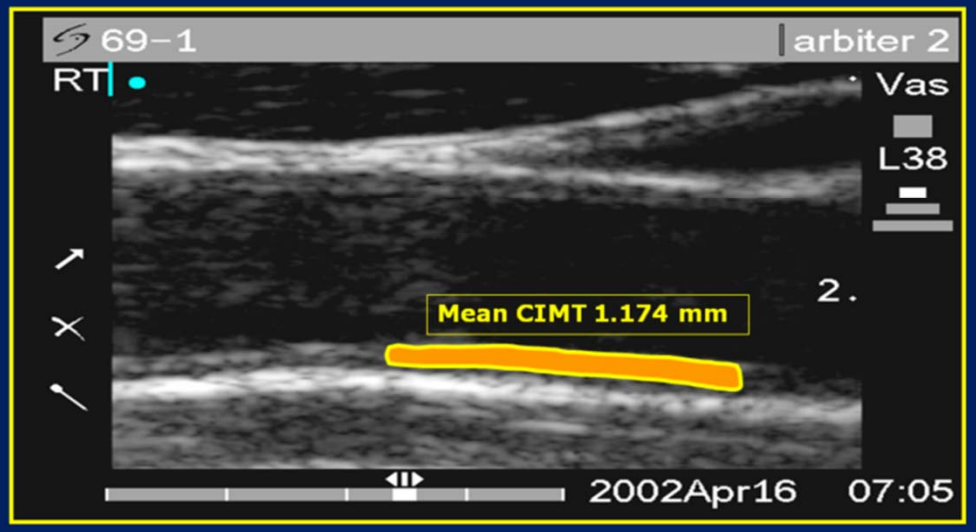
Real time and color duplex ultrasonography was utilized to interrogate the carotid arteries bilaterally.

RIGHT: The common carotid artery, bulb, internal and external carotid arteries are well demonstrated. Mild plaque carotid bulb and bifurcation. Doppler waveforms and spectral analysis obtained along the internal carotid artery are consistent with 1-39 % stenosis. The vertebral artery demonstrates antegrade flow.

LEFT: The common carotid artery, bulb, internal and external carotid arteries are well demonstrated. Mild plaque carotid bulb and bifurcation. Doppler waveforms and spectral analysis obtained along the internal carotid artery are consistent with 1-39% stenosis. The vertebral artery demonstrates antegrade flow.

IMPRESSION:
1. 1-39% STENOSIS INTERNAL CAROTID ARTERY BILATERALLY.

Carotid Intima-Media Thickness (CIMT)



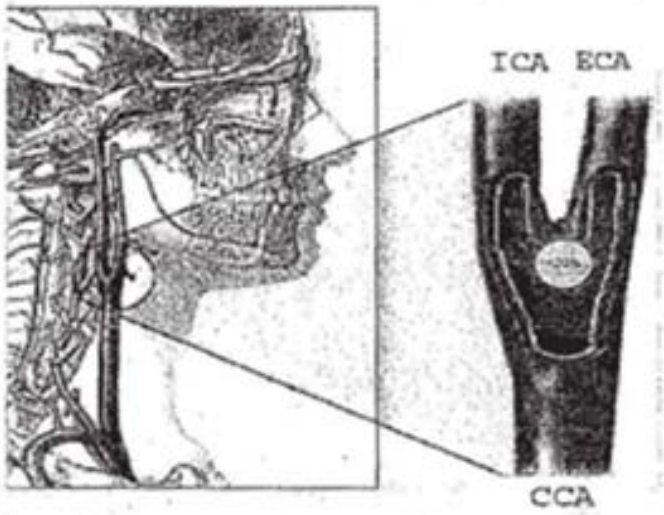
- A limited carotid ultrasound
- The mean common carotid artery (CCA) most reliable
- Measurements compared to expected for age & gender, reported as a percentile
- Increased thickness is a risk factor for CAD and stroke, especially when plaque is present also
- Generally >1.5 mm = “plaque without stenosis”

Carotid Intima-Media Thickness (CIMT)

Visualized Plaque and Atherosclerotic Burden Assessment

Name: [redacted] DOB: [redacted] Age: 49 Gender: Male Date: 8/30/07

Right



Comments
Soft homogeneous plaque noted right carotid bulb, 1.907mm.

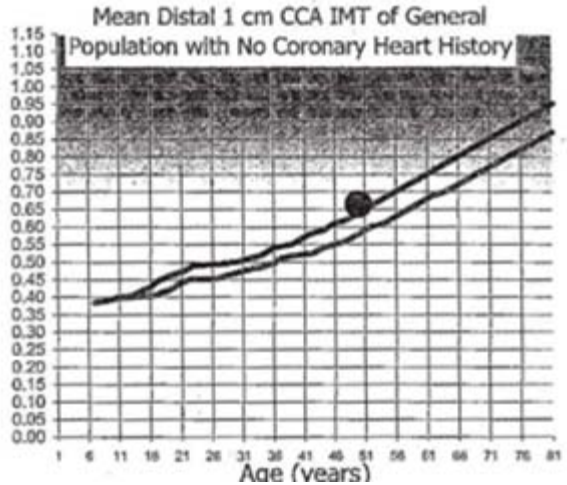
Left

Comments
Soft homogeneous plaque noted left carotid bulb, 1.248mm.

*Carotid lumen stenosis greater than percentage noted, if clinically indicated refer for carotid doppler flow study.

Carotid-IMT

Your average CIMT carotid wall thickness is: 0.665
Putting you in the 58th percentile for sex and age
You have the arteries of a 51 year old Male
A C-IMT of less than 0.60 mm is generally considered healthy
Comments: 49 year old Male for cardiovascular risk stratification.



Key Underwriting Considerations: Treatment

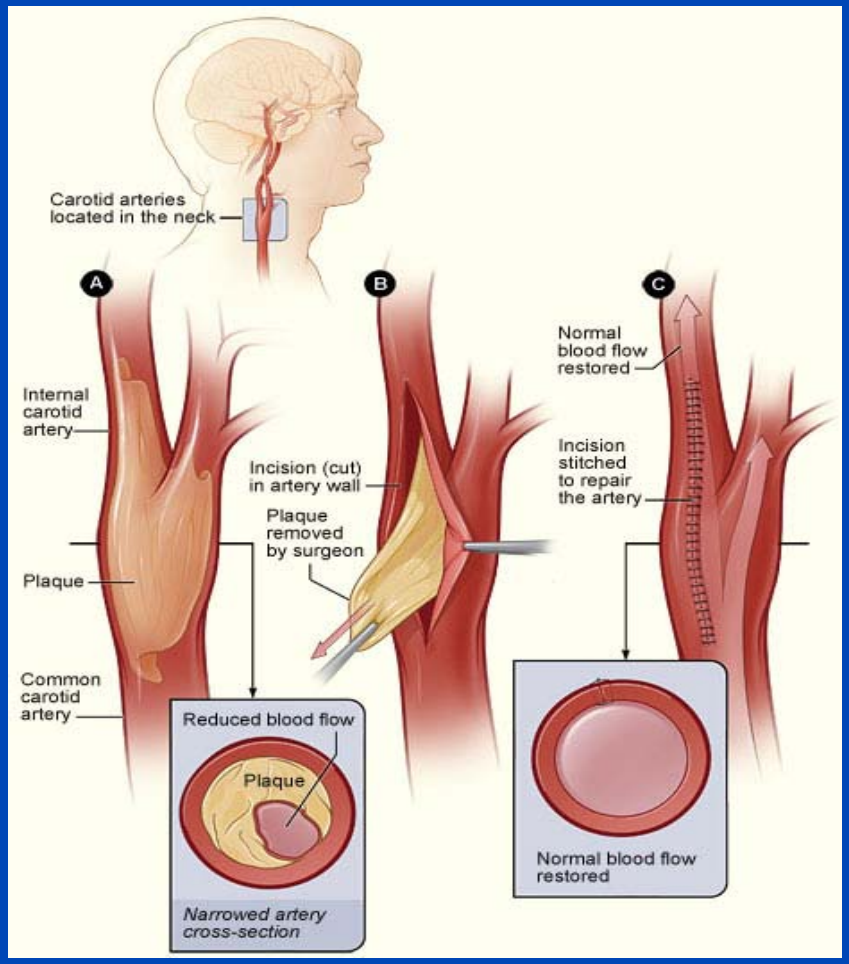
Medical Treatment:

- Aggressive management of risk factors
- Antiplatelet therapy: Aspirin, Plavix, or Aggrenox
- Surveillance: Annual carotid US when >50% until stability established

Surgical Treatment (Revascularization):

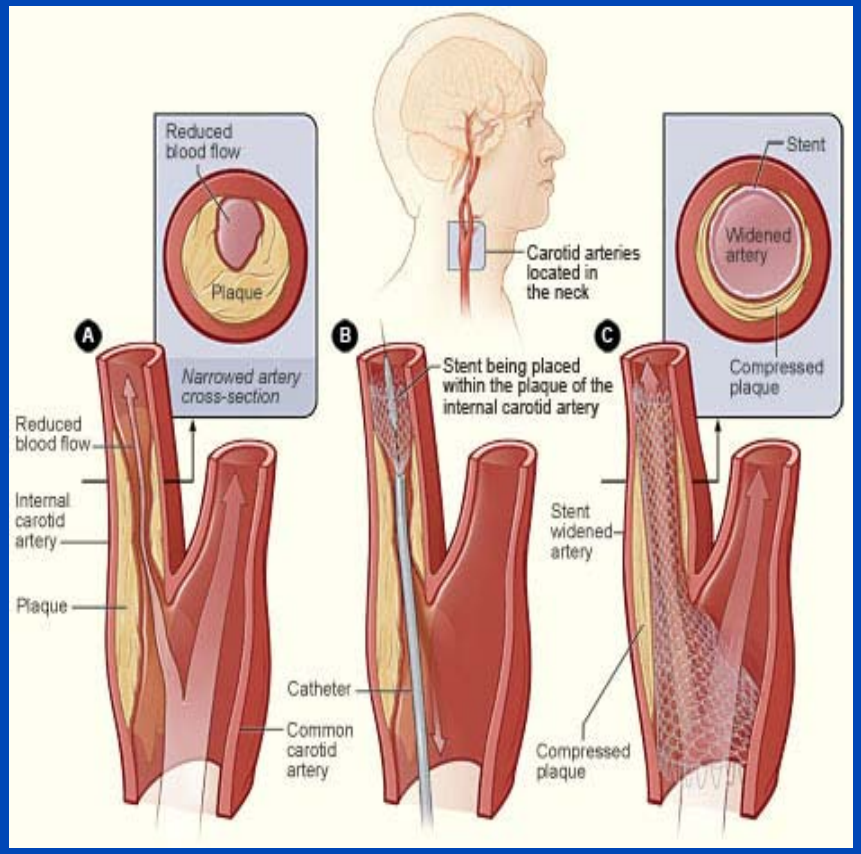
- Carotid Endartectomy (CEA)
- Carotid Artery Stent (CAS)

Carotid Endartectomy (CEA)



- Safe & effective for reducing risk of ischemic stroke with ≥70% stenosis
- Moderate benefit with 50-69% stenosis if symptomatic at age ≥ 75 yrs
- <50% stenosis do not benefit from CEA

Carotid Artery Stenting (CAS)



- An alternative to CEA for selective symptomatic patients with >70% ICA stenosis
- Long term outcomes are similar to CEA
- 30 day risk of death or stroke is higher than for CEA

Carotid Stenosis
Key Underwriting Considerations

- Underlying cause
- Presence of cardiovascular risk factors
- Whether symptomatic or symptomatic
- Severity of Stenosis – Imaging Studies
- Treatment
- Interim history and follow-up 
  - What has happened since? Interim symptoms, studies, treatment, control of CV risk factors

Remember our case example…

A 55 year old male, in the ER 2 years ago with acute onset of left arm weakness

- Focal symptoms lasted 90 minutes
- Risk factors: Age 55, HTN on tx, BP 160/90, Tobacco use
- CT, echocardiogram and EKG nl
- Right carotid bruit on exam

Case Example - Carotid Ultrasound

Exam: US CAROTID ART

Clinical History: Carotid bruit. Hypertension.

PREVIOUS STUDY:

PLAQUE: RIGHT CCA: - BULB: - ICA: - ECA: -
LEFT CCA: - BULB: - ICA: - ECA: -

VELOCITY cm/sec

	RIGHT CURRENT	LEFT CURRENT
ICA:	105	103
ECA:	84	62
CCA:	108	99
ICA/CCA:	1.0	1.0
VERTEBRAL FLOW:	Antegrade	Antegrade

CONCLUSION:

1. There are findings suggesting less than 50% stenosis in the right internal carotid artery.

2. Velocity measurements suggest less than 50% stenosis is the left internal carotid artery.

3. There is antegrade flow in the vertebral arteries.

Case Example – Discussion

Questions ?