The Challenges of Underwriting TIA and Carotid Artery Stenosis

WAHLU Underwriting Conference
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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

<table>
<thead>
<tr>
<th>Cause</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thrombus</strong></td>
<td>• Atherosclerosis i.e. carotid artery stenosis or total obstruction</td>
</tr>
<tr>
<td></td>
<td>• Thrombosis secondary to arteritis, arterial dissection, vasospasm from drugs (such as cocaine), clotting disorder (hypercoaguuable state), or hematologic disorder</td>
</tr>
</tbody>
</table>
# Causes of Cerebral Ischemia

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

- Thrombus
- Emboli from a thrombus
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
• **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
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
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, vertebrales
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
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

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Points</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td><strong>Age ≥ 60 years</strong></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>BP</strong> Syst BP ≥ 140 mmHg OR Diast BP ≥ 90 mmHg</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Clinical Features of TIA (choose one)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral weakness with or without speech impairment</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speech impairment without unilateral weakness</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td></td>
<td></td>
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<tr>
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<td></td>
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<tr>
<td><strong>Diabetes</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Total ABCD2 score</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABCD2 Score</td>
<td>2-day Stroke Risk</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>0-3</td>
<td>1.0%</td>
<td>Hospital observation may be unnecessary without another indication (e.g. new Afib)</td>
</tr>
<tr>
<td>4-5</td>
<td>4.1%</td>
<td>Hospital observation justified in most situations</td>
</tr>
<tr>
<td>6-7</td>
<td>8.1%</td>
<td>Hospital observation worthwhile</td>
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### 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

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## More Likely or Less Likely a TIA??

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### ABCD2 Score 2-day Stroke Risk

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<th>ABCD2 Score</th>
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<tbody>
<tr>
<td>0-3</td>
<td>Low</td>
</tr>
<tr>
<td>4-5</td>
<td>Intermediate</td>
</tr>
<tr>
<td>6-7</td>
<td>High</td>
</tr>
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</table>
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
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

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

Heirarchy of Carotid Imaging Studies

Carotid Angiogram

Magnetic Resonance Imaging (MRI / MRA)

Computerized Tomography (CT/CTA)

Carotid Duplex Ultrasound

Carotid Intima-Media Thickness (CIMT)
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

<table>
<thead>
<tr>
<th>% Stenosis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>Normal</td>
</tr>
<tr>
<td>1 – 49%</td>
<td>Plaque or intimal thickening</td>
</tr>
<tr>
<td></td>
<td>Minimal, mild, mild-to-moderate</td>
</tr>
<tr>
<td>50 – 69%</td>
<td>Moderate</td>
</tr>
<tr>
<td>70 – 95%</td>
<td>Severe</td>
</tr>
<tr>
<td>100%</td>
<td>Complete occlusion</td>
</tr>
</tbody>
</table>

## Carotid Duplex Ultrasound
### Blood Flow Velocity Measurements

<table>
<thead>
<tr>
<th>% Stenosis</th>
<th>ICA PSV*</th>
<th>ICA/CCA PSV ratio</th>
<th>ICA EDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>None 1-49%</td>
<td>&lt; 125 cm/sec</td>
<td>&lt; 2.0</td>
<td>&lt; 40 cm/sec</td>
</tr>
<tr>
<td>50% to 69%</td>
<td>125 to 230 cm/sec</td>
<td>2.0 to 4.0</td>
<td>40 to 100 cm/sec</td>
</tr>
<tr>
<td>70% to 99%</td>
<td>&gt; 230 cm/sec</td>
<td>&gt; 4.0</td>
<td>&gt; 100 cm/sec</td>
</tr>
<tr>
<td>100%</td>
<td>No signal</td>
<td>No signal</td>
<td>No signal</td>
</tr>
</tbody>
</table>

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

**CAROTID DUPLEX ULTRASOUND**

<table>
<thead>
<tr>
<th>VESSEL</th>
<th>RIGHT (cm/sec)</th>
<th>LEFT (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCA Peak systolic velocity</td>
<td>94</td>
<td>97</td>
</tr>
<tr>
<td>ICA Peak systolic velocity</td>
<td><strong>57</strong></td>
<td><strong>85</strong></td>
</tr>
<tr>
<td>ICA and diastolic velocity</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>ECA Peak systolic velocity</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>ICA/CCA RATIO:</td>
<td>0.6</td>
<td>0.9</td>
</tr>
</tbody>
</table>

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.
• 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

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.

Mean Distal 1 cm CCA IMT of General Population with No Coronary Heart History
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 Endarterectomy (CEA)
- Carotid Artery Stent (CAS)
Carotid Endarterectomy (CEA)

- Safe & effective for reducing risk of ischemic stroke with $\geq 70\%$ stenosis
- Moderate benefit with 50-69\% stenosis if symptomatic at age $\geq 75$ 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 asymptomatic
- 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:**

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**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 ?