
**ED Transient Ischemic Attack
Patient Management:
Can At-risk Ischemic Stroke
Patients Be Identified?**

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Session Objectives

- Review the data that quantifies what is the risk of acute ischemic stroke in the early days following an ED visit for an acute transient ischemic attack.
- Discuss how those TIA patients who are at greatest risk for a subsequent ischemic stroke can be identified and optimally managed in the ED.

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Case Presentation...

- 62 yo male brought in by paramedics
- Paramedics called due to left arm feeling heavy and slurred speech while driving car
- On paramedic arrival, he has a facial droop, slurred speech and a weak left grip
- Symptoms resolve en route to the hospital
- Total duration of symptoms was estimated to be about 30 minutes

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Case Presentation...

- PMHx of NIDDM
- POC glucose 217
- Not on ASA or any other antiplatelet therapy.
- In the ED, the patient's neurological exam is normal

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Clinical Questions

- What is the risk of an ischemic stroke following an ED TIA evaluation?
- What is the ischemic stroke risk within the first 2 - 7 days of an ED TIA, such that hospital admission may be clinically indicated?
- Can risk following an ED TIA presentation be stratified, and based on what demographic and clinical evaluation factors?

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Clinical Questions

- What diagnostic testing must be performed in order to allow for outpatient evaluation and follow-up for ED TIA patients?
- Which ED TIA patients might be the best candidates for outpatient evaluation and follow-up? Which ED TIA patients should in all instances be admitted?
- Are there publications or clinical guidelines that provide a suggested approach to the ED evaluation and disposition of TIA patients?

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Classic TIA Definition

- Temporary stroke symptoms caused by a decrease in the blood flow to a specific area of the brain
- Lasting less than 24 hours
- Causing no permanent neurologic deficit

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TIA Definition Changing

- True TIAs almost all resolve within 1 hour
- At 24 hours, <15% patients with symptoms lasting > 1 hour will have complete resolution
 - NINDS placebo group had only 2% complete resolution at 24 hours symptoms, if not completely resolved within 1 hour
- Several series of patients with "normal" neuro exams who underwent acute MRI scanning have demonstrated injury
 - 1/2 of these patients had permanent defects on subsequent follow-up testing

Albers GW et al. *N Engl J Med* 2002;347:1713-1716.

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TIA Working Group Definition

- "Brief episode of neurologic dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction"
 - Implies need for MRI before accurate diagnosis

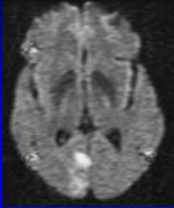
Albers GW et al. *N Engl J Med* 2002;347:1713-1716.

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MRI versus CT

- DWI can detect ischemic lesions within minutes of the event
 - CT and conventional (T2-weighted) MRI takes 8 to 48 hours to demonstrate the lesion
 - Incidence of identifying a lesion with DWI ranges from 21% to 67%
- Not all DWI-positive TIA lesions evolve to a completed infarction on follow-up imaging




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TIA Conceptual Change

- TIA is a process, not an event
- A completed stroke within 48 hours of a TIA diagnosis is probably a fluctuating deficit not a new event
 - How do we best intervene in that process?

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TIA realities

- Often impossible to confirm TIA dx
- Agreement between independent observers on TIA dx poor
 - Even among neurologists
- Clinical decisions most frequently based on non-neurologist's diagnostic impression

Calanchini PR et al. JAMA 1977;238:2029-2033.
 Tomasetto F et al. Stroke 1982;13:32-35.
 Kraaijeveld CL et al. Stroke 1984;15:723-725.
 Shinar D et al. Arch Neurol 1985;42:557-565.
 Koudstaal PJ et al. Stroke 1989;20:300-301.

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TIA Symptoms

Anterior Circulation
 Hemiparesis
 Unilateral sensory loss
 Visual field deficit (monocular blindness)
 Gaze preference
 Aphasia
 Left-sided spatial neglect or hemiattention

Posterior Circulation
 Several of the following usually present:
 Hemiparesis
 Quadriparesis ("locked-in" syndrome allows movement of the upper lids only)
 Hemisensory loss or sensory loss in all 4 extremities
 "Crossed" deficits
 Diplopia
 Disconjugate gaze
 Gaze palsy
 Nystagmus
 Dysarthria with dysphagia
 Vertigo
 Decreased level of consciousness
 Limb or gait ataxia
 Intractable vomiting


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Probably not a TIA

- Global phenomena
 - Wooziness
 - Lightheadedness
- Positive neurological symptoms
 - Visual phenomena
 - Involuntary movements
- March or migration of symptoms
- Without discrete, sudden onset?
- Waxing and waning symptoms?

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A Therapeutic Window after TIA?

- Among 210 consecutive referrals of suspected TIA to a weekly TIA clinic
- Median time from referral to clinic appointment was 9 (4-16) days
 - 42% seen within 7 days of referral
- During delay between referral and scheduled clinic appointment
 - 5% (n=11) patients had a stroke
 - 9/11 admitted to the hospital with disabling events

Rothwell et al. Lancet 2005;366:29-36.


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Potential Benefits of Short-stay Hospital Admission

- Expedited diagnostic evaluation
- Monitoring of fluctuating patients
 - Ready access to thrombolysis?
- Facilitation of early carotid revascularization
- Greater opportunity for risk factor modification


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Evidence for Rapid Application of Stroke Prevention Strategies: CEA

- Benefit of CEA is time dependent
- Surgery most effective when performed within 2 weeks of the index ischemic event
 - NNT of 5 (to prevent 1 stroke in 5 years)
- Benefit declines dramatically over time
 - NNT of 125 if surgery delayed >12 weeks after the ischemic event


Rothwell PM et al. *Lancet* 2004;363:915-924. Andrew Asimos, MD, FACEP



CEA Delay & Risk of Recurrent Stroke

- 853 patients undergoing carotid imaging after TIA or stroke
- The risk of stroke prior to CEA in subpopulation with $\geq 50\%$ stenosis
 - 21% (8-34%) at 2 weeks
 - 32% (17-47%) at 12 weeks
- Half of all strokes were disabling or fatal


Fairhead JF et al. *Neurology* 2005; 65(3):371-5. Andrew Asimos, MD, FACEP



Evidence for Rapid Application of Stroke Prevention Strategies: Antiplatelet Therapy

- All of the stroke prevention studies investigating antiplatelet therapies have enrolled patients late after stroke or TIA onset
- Only the IST and CAST showed a reduced recurrence of stroke in the first 2 weeks
 - ARR of about 1% when ASA given in the first 48 hrs


CAST collaborative group. *Lancet* 1997;349:1641-1649. Andrew Asimos, MD, FACEP



TIA Evaluation Consensus Guidelines

Management	American Heart Association	National Stroke Association
Laboratory testing	No routine, standard evaluation stepwise approach tailored to medical history	No particular recommendations
ECG	Recommended	Recommended
Brain imaging	CT recommended; routine MRI use not recommended	No particular recommendations
Carotid imaging	Prompt evaluation with ultrasonography, MRI, or CT angiography	Urgent evaluation
Antithrombotics for cardioembolic source	Oral anticoagulation for atrial fibrillation	Consider acute anticoagulation
Antithrombotics: noncardioembolic source	ASA, other options: clopidogrel, ticlopidine, or ASA plus dipyridamole	ASA, other options: clopidogrel, ticlopidine, or ASA plus dipyridamole
Hospitalization	No particular recommendations	Recommended if appropriate imaging studies not available

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Stroke Risk after TIA

	Kaiser 2000 (n=1,707)	Oxford CP 2003 (n=209)	Oxford VS 2004 (n=87)	Alberta 2004 (n=2,285)	Ontario 2004 (n=265)	GCNK 2005 (n=927)
2 Days	5%				3%	4%
7 Days		9%	8%		4%	7%
1 Month		12%	12%		5%	11%
3 Months	11%		17%	10%	6%	15%
6 Months						17%
1 Year				15%		

Johnston SC et al. *JAMA* 2000;284:2901-2906.
 Kleindorfer K et al. *Stroke* 2005;36:720-724.
 Lovett JK et al. *Stroke* 2003;34(3):338-40.
 Coull AJ et al. *BMJ* 2004;328(7439):328.
 Gladstone DJ et al. *CMAJ* 2004;170(7):1099-1104.
 Hill MD et al. *Neurology* 2004;62(11):2015-20.

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ORIGINAL CONTRIBUTION

Short-term Prognosis After Emergency Department Diagnosis of TIA

S. Claiborne Johnston, MD, MPH
 Daryl R. Gress, MD
 Warren S. Browner, MD, MPH
 Stephen Sidney, MD, MPH

Context Management of patients with acute transient ischemic attack (TIA) varies widely, with some institutions admitting all patients and others proceeding with outpatient evaluations. Defining the short-term prognosis and risk factors for stroke after TIA may provide guidance in determining which patients need rapid evaluation.

Objective To determine the short-term risk of stroke and other adverse events after emergency department (ED) diagnosis of TIA.

Design and Setting Cohort study conducted from March 1997 through February 1998 in 16 hospitals in a health maintenance organization in northern California.

Patients A total of 1707 patients (mean age, 72 years) identified by ED physicians as having presented with TIA.

Main Outcome Measures Risk of stroke during the 90 days after index TIA; other events, including death, recurrent TIA, and hospitalization for cardiovascular events.

Results During the 90 days after index TIA, 180 patients (10.5%) returned to the ED with a stroke, 91 of which occurred in the first 2 days. Five factors were independently associated with stroke: age greater than 60 years (odds ratio [OR], 1.8; 95% confidence interval [CI], 1.1-2.7, $P < .01$), diabetes mellitus (OR, 2.0; 95% CI, 1.4-2.9, $P < .001$), symptom duration longer than 10 minutes (OR, 2.3; 95% CI, 1.3-4.2, $P < .005$), weakness (OR, 1.9; 95% CI, 1.4-2.6, $P < .001$), and speech impairment (OR, 1.5; 95% CI, 1.1-2.1, $P < .01$). Stroke or other cardiovascular events were more likely to occur in patients who were discharged to home than in those who were hospitalized.

SA WEDNESDAY, DECEMBER 13, 2000 *** NA

Mini-strokes found to be more serious than doctors thought

By LINDSEY TANNER
 Associated Press

HEALTH WATCH

CHICAGO — Mini-strokes that involve brief lapses in blood flow to the brain may be a bigger danger sign than previously thought. Doctors have long known that mini-strokes, or transient ischemic attacks, can be an early warning of a full-blown stroke. But new research suggests the danger may be much more imminent than doctors believed.

In a study of 1,707 patients, 180 had strokes within three months of a transient ischemic attack, or TIA, a 10.5 percent rate that was in line with previous research. But half of the strokes happened within two days of the initial attack.

"No one expected that. That was a surprise," said Dr. Claiborne Johnston, who led the study at the University of California at San Diego. "TIA patients need to basically call 911 and come in right away," Johnson said. "They need to be taken very seriously by the patient and by the hospital."

Dr. John Marler of the National Institutes of Health, which helped fund the study, agreed that such patients may need immediate hospitalization, which could allow prompt treatment as well as quick use of diagnostic measures such as brain scans and ultrasound.

About 300,000 Americans each year have TIAs. Symptoms include sudden numbness and blurred vision but disappear within about 15 minutes to 24 hours and do not cause permanent damage.

Doctors commonly send TIA patients home, thinking "that the symptoms would be gone by the time they get to the hospital."

TIAs are difficult to diagnose, partly because symptoms often clear up by the time a patient receives medical attention. Some patients do not even call the doctor. Johnson said even patients whose symptoms go away should seek immediate treatment.

Treatment for TIAs varies widely. It may include aspirin and other blood thinners or surgery to clear blocked carotid arteries.

Some hospitals may send patients home with little or no treatment. In the study, just 14 percent were hospitalized and 8 percent received no treatment, which Johnson said is typical. Aspirin was the most common treatment.

The researchers studied patients age 72 on average who were

Methods

- "Observational cohort study" conducted from 3/97-2/98
 - Retrospective chart review
- 1797 pts
- 16 Kaiser-Permanente hospitals
- Charts abstracted using predefined criteria
- Patients followed up by review of medical records and computer records to record 90 - day adverse events

Johnston SC et al. JAMA 2000;284:2901-2906. Andrew Asimos, MD, FACEP

Results

- 1707 of 1797 pts included in final analysis
- 99% arrived within 1 day of symptom onset
 - Symptoms present on arrival in half of pts
- Mean age = 72
- Mean symptom duration = 207 minutes

Johnston SC et al. JAMA 2000;284:2901-2906. Andrew Asimos, MD, FACEP

Results

- Strokes occurred in 180 pts (10.5%) within 90 days
 - 5% (n=91) occurred within first 2 days
- Fatal in 38 pts
- Disabling in 115 pts

Johnston SC et al. JAMA 2000;284:2901-2906. Andrew Asimos, MD, FACEP

Independent Risk Factors for Stroke within 90 Days

	Odds Ratio (95% CI)	P Value
Age > 60 y	1.8 (1.1-2.7)	.01
Diabetes Mellitus	2.0 (1.4-2.9)	<.001
> 10 min Duration	2.3 (1.3-4.2)	.005
Weakness	1.9 (1.4-2.6)	<.001
Speech Impairment	1.5 (1.1-2.1)	.01

Johnston SC et al. JAMA 2000;284:2901-2906. Andrew Asimos, MD, FACEP

90-Day Stroke Risk by Number of Risk Factors

# Risk Factors	No. (%)	
	Patients	Stroke within 90 days
0	22 (1)	0 (0)
1	179 (10)	5 (3)
2	509 (30)	35 (7)
3	584 (34)	63 (11)
4	337 (20)	51 (15)
5	76 (4)	26 (34)

Johnston SC et al. JAMA 2000;284:2901-2906. Andrew Asimos, MD, FACEP

- ### Study Implications
- Prospective validation required prior to development of a prediction model
 - Provides no data on efficacy of TIA therapies
 - Suggests the pace of TIA evaluation may be adjusted based on risk stratification
- Johnston SC et al. JAMA 2000;284:2901-2906. Andrew Asimos, MD, FACEP

A comparison of risk factors for recurrent TIA and stroke in patients diagnosed with TIA

S. Claiborne Johnston, MD, PhD; Steve Sidney, MD, MPH; Allan L. Bernstein, MD; and Daryl R. Gross, MD

Abstract—Background: Some spells consistent with TIA may be benign, such as those produced by migraine or migraine accompaniments in the elderly. Distinguishing these from embolic or thrombotic events may be difficult. **Methods:** Emergency department physicians identified patients who presented with a presumed TIA at one of 16 hospitals in Northern California from March 1997 through February 1998. Recurrent TIAs and strokes were recorded for 90 days afterwards. **Results:** Of 1,707 patients in whom TIA had been diagnosed in the emergency department, 191 (11.2%) had a recurrent TIA and 180 (10.5%) had a stroke during 90-day followup. Independent risk factors for recurrent TIA were age >60 years (odds ratio 1.9; 95% CI 1.2 to 2.9; $p = 0.003$), history of multiple TIAs (odds ratio 2.9; 2.1 to 4.0; $p < 0.001$), duration of spell ≤ 10 minutes (odds ratio 2.3; 1.6 to 3.3; $p < 0.001$), and sensory abnormality associated with the spell (odds ratio 1.9; 1.4 to 2.6; $p < 0.001$). Independent risk factors for stroke from a previous analysis were age, duration > 10 minutes, diabetes, weakness, and speech impairment. Among the 30 patients with isolated sensory symptoms lasting ≤ 10 minutes, the risk of recurrent TIA was 40% and none had a stroke. **Conclusions:** In patients in whom TIA has been diagnosed in the emergency department, risk factors for subsequent stroke and recurrent TIA are different. A subset of patients with presumed TIA has a benign short-term course with multiple brief TIAs more frequently characterized by sensory symptoms.

NEUROLOGY 2003;60:280-285

Distinguishing TIA due to thrombosis or embolism from other causes of temporary neurologic symptoms is difficult.¹ Seizure, migraine accompaniments, vasospasm, syncope, and peripheral vestibulopathy are the risk factors for stroke identified in the previous study (age, longer duration of initial symptoms, diabetes mellitus, and weakness and speech impairment with the event) may simply be markers for

Benign Recurrent TIAs

Variable	n (%)	Recurrent TIA risk (%)	Stroke risk (%)
Overall	1,707 (100)	11	11
Duration ≤ 10 min	266 (16)	21	5
Multiple TIAs	452 (26)	21	11
Absence of diabetes	1,375 (81)	11	9
Isolated sensory symptoms	161 (9)	19	4
And duration ≤ 10 min	30 (2)	40	0
And multiple TIAs	60 (4)	33	2
And absence of diabetes	140 (8)	21	3
Isolated visual symptoms	26 (2)	23	0

Johnston SC et al. Neurology 2003;60:280-285. Andrew Asimos, MD, FACEP

Articles

A simple score (ABCD) to identify individuals at high early risk of stroke after transient ischaemic attack

P M Rothwell, M F Giles, E Flossmann, C E Lovelock, J N Ebdon, C P Warlow, Z Mehta

Abstract
Background Effective early management of patients with transient ischaemic attacks (TIA) is undermined by an inability to predict who is at highest early risk of stroke.

Methods We derived a score for 7-day risk of stroke in a population-based cohort of patients (n=209) with a probable or definite TIA (Oxfordshire Community Stroke Project; OCSF), and validated the score in a similar population-based cohort (Oxford Vascular Study; OXVASC; n=190). We assessed likely clinical usefulness to front-line health services by using the score to stratify all patients with suspected TIA referred to OXVASC (n=378; outcome: 7-day risk of stroke) and to a hospital-based weekly TIA clinic (n=219; outcome: risk of stroke before appointment).

Results A six-point score derived in the OCSF (age ≥ 60 years=1, blood pressure [systolic > 140 mm Hg and/or diastolic ≥ 90 mm Hg]=1), clinical features [unilateral weakness=2, speech disturbance without weakness=1, other=0], and duration of symptoms in min ($\geq 60=2, 10-59=1, < 10=0$); ABCD) was highly predictive of 7-day risk of stroke in OXVASC patients with probable or definite TIA ($p < 0.0001$), in the OXVASC population-based cohort of all referrals with suspected TIA ($p < 0.0001$), and in the hospital-based weekly TIA clinic-referred cohort ($p = 0.006$). In the OXVASC suspected TIA cohort, 19 of 20 (95%) strokes occurred in 101 (27%) patients with a score of 5 or greater. 7-day risk was 0-6% (95% CI 0-1) in 274 (73%) patients with a score less than 5, 12-13% (4-2-20-0) in 66 (15%) with a score of 5, and 31-41% (16-9-46-3) in 35 (9%) with a score of 6. In the hospital-referred clinic cohort, 14 (7-5%) patients had a stroke before their scheduled appointment, all with a score of 4 or greater.

Conclusions Risk of stroke during the 7 days after TIA seems to be highly predictable. Although further validation


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 M F Rothwell (FRCP), M F Giles (MRCP), E Flossmann (MRCP), C E Lovelock (FRCP), J N Ebdon (MRCP), C P Warlow (MRCP), Z Mehta (FRCP), and Department of Clinical Neurosciences, University of Edinburgh, Western General Hospital, Edinburgh, UK
 (Prof C P Warlow FRCP)
 Correspondence to Prof Peter M Rothwell

- ### ABCD Score to Identify Patients at High Early Risk for Stroke after TIA
- Score for 7-day risk of stroke after TIA
 - Derived and validated in 2 population based patient cohorts
 - Oxfordshire Community Stroke Project (n=209)
 - Oxford Vascular Study (n=190)
- Rothwell et al. Lancet 2005;366:29-36. Andrew Asimos, MD, FACEP

ABCD Score

Risk Factor	Score
Age ≥60	1
SBP >140 mm Hg and /or DBP ≥90 mm Hg at TIA presentation	1
Unilateral weakness	2
Speech disturbance without weakness	1
Symptom duration ≥60 minutes	2
Symptom duration 10-59 minutes	1
Symptom duration <10 minutes	0


Rothwell et al. *Lancet* 2005;366:29-36. Andrew Asimos, MD, FACEP





7-Day Stroke Risk Stratified According to ABCD Score: OXVASC Validation Cohort


	Patients (%)	Strokes (%)	% risk (95% CI)
ABCD score			
≤1	2 (1%)	0	0
2	28 (15%)	0	0
3	32 (17%)	0	0
4	46 (24%)	1 (5%)	2.2 (0-6.4)
5	49 (26%)	8 (40%)	16.3 (6.0-26.7)
6	31 (16%)	11 (55%)	35.5 (18.6-52.3)
Total	188 (100%)	20 (100%)	10.5 (6.2-14.9)


Rothwell et al. *Lancet* 2005;366:29-36. Andrew Asimos, MD, FACEP



- ### Impact of Weakness and Speech Disturbance
- In the validation cohort, all strokes within 7 days of TIA occurred in the 51% of patients who had focal weakness or speech disturbance
- Rothwell et al. *Lancet* 2005;366:29-36. Andrew Asimos, MD, FACEP
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- ### ABCD Score Study Impact on TIA Evaluation
- Timely outpatient workup if low ABCD score
 - Admission if ABCD score ≥ 5
 - Minority of all TIAs
- Rothwell et al. *Lancet* 2005;366:29-36. Andrew Asimos, MD, FACEP
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- ### Is the ABCD Score Useful for Risk Stratification of Patients With Acute TIA?
- Prospective study of 117 TIA patients over 3 years
 - Diagnosed by a neurologist, using the classic <24-hour definition
 - Hospitalized within 48 hours of symptom onset
- Cucchiara BL et al. *Stroke* 2006; 37(7):1710-1714. Andrew Asimos, MD, FACEP
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- ### Is the ABCD Score Useful for Risk Stratification of Patients With Acute TIA?
- Primary Outcome Measure was
 - Dichotomization of subjects into high-risk and low-risk categories
 - High-risk group
 - Stroke or death within 90 days
 - ≥50% stenosis in a vessel referable to symptoms
 - Cardioembolic source warranting anticoagulation
- Cucchiara BL et al. *Stroke* 2006; 37(7):1710-1714. Andrew Asimos, MD, FACEP
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Results

- 26 patients (22%) classified as high risk
 - Clinical events occurred in 4 patients
 - 2 strokes, 2 deaths
 - A $\geq 50\%$ stenosis in a vessel referable to the patient's symptoms was found in 15 patients (14%)
 - A cardioembolic source warranting anticoagulation was found in 10 patients (9%)

Cucchiara BL et al. Stroke 2006; 37(7):1710-1714.

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Results

- Increasing ABCD scores were marginally associated with increasing risk, but not with abnormalities on DWI ABCD scores in the 2 patients with stroke were 3 and 6
 - Strokes occurred 26 hours and 39 hours after TIA onset
- Both patients who died had an ABCD score of 5
- Patients without weakness or speech disturbance still had significant probability of being high risk (15%) or DWI+ (8%)

Cucchiara BL et al. Stroke 2006; 37(7):1710-1714.

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Is the ABCD Score Useful for Risk Stratification of Patients With Acute TIA?

- Although some predictive value to the ABCD risk score, its discriminatory ability not optimal
- Patients with a score of 0 to 3 still had a clinically significant probability of having stroke within 90 days, or a high-risk cause of cerebral ischemia warranting specific intervention
 - Roughly in the 10% to 20% range
- Similar percentage had evidence of infarction on early MRI

Cucchiara BL et al. Stroke 2006; 37(7):1710-1714.

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Conclusions

- Future imaged based TIA definition?
- Isolated visual or sensory symptoms suggest low short term risk for stroke
- Pace and setting of work up dependent on perceived short term risk
- Prediction rules require prospective validation

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Recommendations

- Utilize emergent MRI testing when available
- Admit those with perceived highest risk
- Disposition others based on consideration of all factors
- Assess best practice via an observation unit study

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Questions?

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