


There's Nothing "Mini" about TIA

Daniel Labovitz MD, MS

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New York University
School of Medicine
Department of Neurology
Division of Cerebrovascular Disease

Daniel Labovitz MD, MS
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Outline

- **Defining and Diagnosing TIA**
 - One hour versus 24 hours
 - How to separate TIA from other spells
- **TIA incidence: how common is it?**
 - Incidence in Greater Cincinnati
 - 3-month outcome: risk of disability and death
- **Predicting outcome after TIA**
 - The meaning of an ED diagnosis of TIA
 - The "TIA Score"
 - **Race-ethnic variation in hospitalization for TIA**
 - The St. Luke's-Roosevelt TIA Registry
 - Who comes in with "soft" TIAs?

Problems defining, diagnosing TIA


- **Duration: how long is "brief"?**
 - 24 hours?
 - 1 hour?
- **Imaging: does it matter if there is an acute lesion on the MRI?**
- **Deciding whether transient symptoms are vascular is difficult**
 - Many TIA mimics
 - Signs have resolved before evaluation
 - Patients have trouble describing symptoms
 - Inter-rater reliability between neurologists is low

NINDS Definition of TIA: <24 Hours



- **Sudden, focal, vascular neurologic deficit**
 - Involves brain territory served by a single artery
 - Imaging results not considered
- **Advantages**
 - Easy to use
 - No variation in diagnosis by use of CT or MRI
- **Disadvantages**
 - Non-physiologic cut-off
 - Greater risk of future stroke if there is an acute lesion

Should TIA be <60 Minutes?




- **New criteria for TIA from a panel of "experts":**
 - "Brief episode, typically less than one hour"
 - Imaging shows no acute stroke
- **Advantages:**
 - If symptoms last > 1 hour, the chance of returning to normal in <24 hours is only 14%
 - Excludes patients with acute infarcts
- **Disadvantages:**
 - Excludes TIA cases lasting >1 hour (15-20%)
 - Impossible to apply systematically to all patients

TIA Working Group, NEJM 2002

TIA mimics

- Simple and complex partial seizures
- Migraine
- Multiple sclerosis
- Acute coronary syndrome
- Root/nerve impingement
- Hypoglycemia
- Syncope
- Panic attack



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History not consistent with TIA

- Gradual build-up of symptoms (>5 minutes)
- Symptoms lasting <30 seconds
- March of symptoms over several areas of body
- Evolution of symptoms from one type to another
- Multiple recurrent spells over several months



Symptoms not consistent with TIA

- Isolated vertigo
- Isolated diplopia
- Isolated dysarthria
- Lightheadedness or syncope
- Binocular visual loss (excluding hemianopia)
- Generalized weakness
- Incontinence
- Sensory impairment
- Amnesia

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TIA Incidence: Cincinnati

- Greater Cincinnati July 1 1993 to June 30 1994
- Identified TIAs inside and outside of hospitals
 - 19 hospitals (ED and hospital discharge diagnoses)
 - 30 public health clinics hospital-based clinics
 - Random sample of nursing homes
 - Random sample of primary care physician's offices



Kleindorfer et al, Stroke 2005

Hunting for TIAs in Cincinnati

- Charts reviewed and TIA diagnosis confirmed by an army of trained nurses
- NINDS definition of TIA (syndrome <24 hours)
- 1023 TIAs identified among 927 patients



TIA Incidence: Sex and Race

- TIA incidence was significantly higher in men and blacks

	TIA incidence (per 100,000)	P-value	Infarct incidence
Total	82.9 (77.9-88.0)		
Men	101.4 (92.4-110.4)	<0.0001	
Women	69.8 (64.0-75.8)		
White	81.3 (76.0-86.6)		137
Black	98.0 (82.1-113.9)	0.025	247

- Relative Risk of TIA in blacks versus whites: 1.4 (RR for infarct in same population: 1.5)

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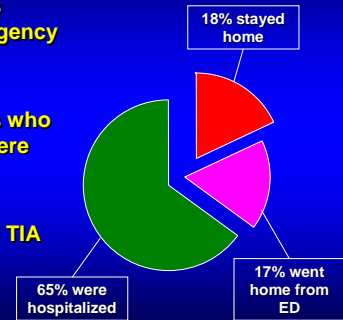
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TIA Prognosis

- **3 month actuarial risk after TIA in Cincinnati:**
 - Infarct 14.6%
 - Death 5.2%
- **Sex and race did not predict stroke or death**
- **Age predicted death but not stroke**
- **Does admission to a hospital affect risk of subsequent stroke or death?**
 - The question remains unanswered
 - Delivery of tPA in-hospital is harder than in the ED
 - More time may be spent alone in hospital than at home

Hospitalization with TIA

- **82% of TIA cases came to an emergency department**
- **79% of TIA cases who came to an ED were admitted**
- **Only about 2/3 of TIA cases were hospitalized**



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Risk of Stroke after TIA

- **California Kaiser Permanente Hospitals, 3/97 to 2/98**
- **Diagnosis of TIA was based on the ED physician diagnosis**
- **1707 cases identified**
 - Mean age 72
 - Mean symptom duration 207 minutes
- **Patients were followed for 3 months—strokes and deaths were detected through Kaiser databases and confirmed by chart review**

Johnston et al. JAMA 2000;284:2901

Outcome after TIA

- **If a Kaiser Permanente ED physician diagnoses TIA, 50% of the stroke risk comes in the next 48 hours**
- **Risk of stroke within 48 hours: 5.3%**
 - Compare perioperative risk of stroke :
 - CABG: 2-4%
 - Carotid endarterectomy: 1-3%
- **Risk of stroke within 90 days: 10.5%**

Stroke Predictors

- **5 independent predictors of subsequent stroke in multivariate analysis:**

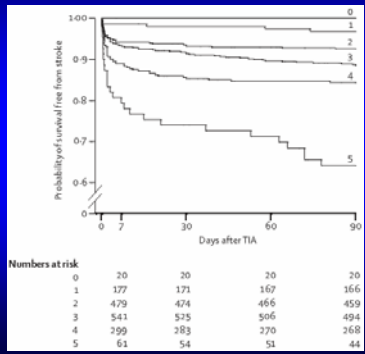
Predictor	OR	p-value
– Age >60 years	1.8	p= 0.01
– Diabetes mellitus	2.0	<0.001
– Duration >10 minutes	2.3	0.005
– Weakness	1.9	<0.001
– Change in speech	1.5	0.01

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Stratified 90-day Risk of Stroke

- Risk increased with the number of factors
 - 0 factors= 0%
 - 3 factors=10%
 - 5 factors=34%



Who were the low risk patients?

- 0/5 risk factors
 - 20 patients
 - None had a stroke at 90 days
- Symptoms were only sensory
 - 161 patients
 - 3% had a stroke by 90 days
- Symptoms were only visual
 - 26 patients
 - None had a stroke at 90 days

Refined Model: The "TIA Score"

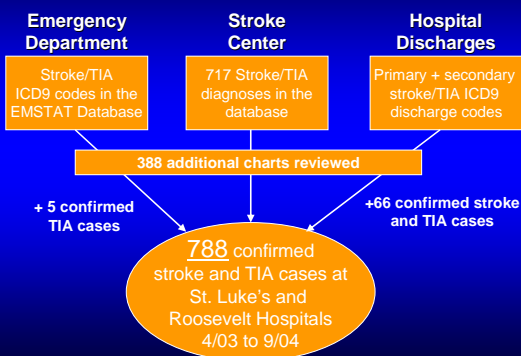
- Validated in 4 fresh TIA cohorts from California and England
- Independent predictors:
 - Motor symptoms
 - Duration >1 hour
 - Diabetes
- Allows creation of a "TIA Score," scale 0-3
 - As the score increases, risk of stroke increases
 - "Highly predictive of 7-day stroke risk after TIA"

Abstract presented at ASA meeting: Johnston et al. Stroke 2006;37:27

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Stroke Registry Design



TIA Diagnosis in the St. Luke's ED

- Which is more important for the ED?

Sensitivity:

Probability of making the diagnosis of stroke/TIA if the patient actually has a stroke/TIA

Positive predictive value:

Probability that the patient has a stroke/TIA if given the diagnosis in the ED

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Sensitivity

62 cases of TIA passed through the ED

--stroke or TIA diagnosed in 59

Sensitivity 95%

287 cases of infarct

--stroke or TIA diagnosed in 229

Sensitivity 80%

66 cases of ICH

--stroke or TIA diagnosed 58

Sensitivity 89%

Positive Predictive Value

- When the ED diagnosed TIA, the final diagnosis was:

- Infarct:	22%
- TIA:	32%
- Other:	46%

- When the ED diagnosed stroke, the final diagnosis was:

- Infarct or ICH:	66%
- TIA:	6%
- Other:	28%

Comparing TIA to Infarct

- If TIA is an infarct that almost happened, TIA cases should be identical to infarct cases
- Differences in hospitalized TIA cases versus infarct cases will reflect variation in:
 - How people decide to come to hospital
 - Likelihood of misdiagnosis
 - Physician bias in diagnosis and admission
- Thus there might be differences in:
 - Demographics
 - Social factors
 - Symptoms

Focus: TIA and Race Ethnicity

- Are whites more likely than blacks or Hispanics to be admitted with a TIA?
- If so, why?

Eligible cases

- 663 cases of infarct and TIA*
 - Exclude strokes occurring in-hospital 68 cases
 - Exclude outside hospital transfers $\frac{13}{582}$
- 582 cases for analysis
 - 418 infarct
 - 164 TIA

*TIA defined by NINDS criteria: deficit <24 hours regardless of imaging (excluding a single case of ICH)

Final Multivariate Model

Odds of coming in with an infarct versus TIA (OR>1 favors infarct)

	OR	(95% CI)*
White	1.0	(reference)
Black	1.7	(1.1-2.6)
Hispanic	1.7	(1.0-2.9)
Other	2.9	(0.9-9.0)
Sensory symptoms	0.4	(0.2-0.6)
Dizziness (not vertigo)	0.4	(0.2-0.8)

*Adjusted for age and sex

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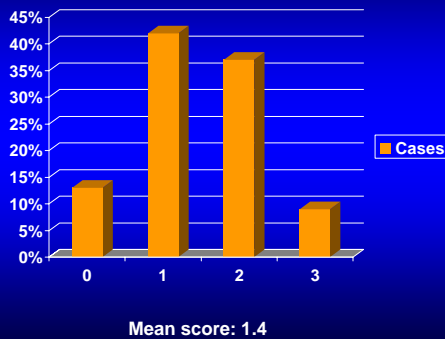
Why more TIAs among whites?

- We know that the incidence of TIA is higher in blacks than whites. Why is the ratio of TIA to infarct greater in whites than blacks?
 - Could blacks be less likely to come to hospital with transient symptoms?
 - Could ED and stroke doctors be less likely to diagnose and admit blacks with TIA?
 - Could whites be more likely to present with low-risk, "soft TIAs"?

Putting the TIA Score to Use

- What is the TIA score measuring?
 - TIA "severity"? No. Diabetes has nothing to do with severity
 - It may indicate the likelihood that the event was truly vascular
- **Hypothesis:** If whites are more likely to be admitted with non-vascular "soft TIAs", then the TIA score among whites will be lower than among blacks and Hispanics

The TIA Score Distribution



Race-ethnicity and the TIA Score

	<u>Mean score</u>	<u>P-value</u>
Whites	1.1	Reference
Blacks	1.6	0.0009
Hispanics	1.7	0.002

- TIA score is significantly lower in whites than blacks or Hispanics
- Whites may be more likely to be hospitalized with "soft TIAs" that carry low risk of subsequent infarct

TIA Evaluation and Treatment

- ...is the same as for ischemic stroke
 - Tests: MRI/MRA, carotid Doppler, TEE, fasting lipid panel, etc, as indicated
 - Medications: antiplatelet therapy (or warfarin for AF), statin, strict BP control, strict glycemic control
- **Clinical trials underway:**
 - Clopidogrel + aspirin vs. aspirin alone within 12 hours (FASTER)
 - Early high-dose statin therapy
- **24-hour urgent evaluation units?**

Conclusions

- Reconsider the diagnosis of TIA in patients with a single sensory or brainstem symptom
- **Some TIAs carry higher risk of stroke than others**
 - Blacks and Hispanics hospitalized with TIA may be at especially high risk of future stroke
 - The "TIA Score" concept is a useful clinical and research tool
 - May permit standardization between studies
 - May help identify patients who do not need hospital admission
- **If you do think it's a TIA, admit. An ED doctor's diagnosis of TIA carries a high risk of stroke within 48 hours**