American Heart Association | American Stroke Association

Learn and Live ®

The American Academy of Neurology (AAN) affirms the value of this paper as an educational tool for neurologists.

Definition and Evaluation of Transient Ischemic Attack

A Scientific Statement for Health Care Professionals from the American Heart Association/American Stroke Association Stroke Council, the Cardiovascular Surgery and Anesthesia Council, the Cardiovascular Radiology and Intervention Council, and the Cardiovascular Nursing Council and the Atherosclerotic Peripheral Vascular Disease Working Group

J. Donald Easton, MD, FAHA, Chair; Jeffrey Saver, MD, FAHA, Vice Chair; Gregory W. Albers, MD; Mark J. Alberts, MD, FAHA; Seemant Chaturvedi, MD, FAHA, FAAN; Edward Feldmann, MD, FAHA; Thomas S. Hatsukami, MD; Randall Higashida, MD, FAHA; S. Claiborne Johnston, MD, PhD; Chelsea S. Kidwell, MD, FAHA; Helmi Lutsep, MD; Elaine Miller, DNS, RN, CRRN, FAHA; Ralph L. Sacco, MD, MS, FAAN, FAHA

Definition and Evaluation of Transient Ischemic Attack slides

- **Edited by**
- **Ramesh Madhavan MD, DM.**
- **Dawn Kleindorfer MD.**
- **Members, AHA Professional Education Committee**

OBJECTIVE

The Scientific statement is designed to aid the clinician

- **in understanding the acute and long term management of patients with Transient Ischemic Attack**

- **will present the early risk of stroke and other vascular outcomes associated with TIA**

Topics reviewed:

Definitions of TIA

Urgency for early management.

Evaluation of TIA

EPIDEMIOLOGY

INCIDENCE AND PREVALENCE

Estimated incidence of TIA in United States - around 200,000 to 500,000/ year; Population prevalence -2.3% (~ five million individuals). [1,2]

Limitations:

- **Precise estimates of the incidence and prevalence of TIAs are difficult to determine due to the varying criteria used in epidemiological studies to identify TIA**
- **lack of recognition of the transitory symptoms may also lead to gross underestimates.**

1.Johnston SC. *N Engl J Med.* 2002;347(21):1687-1692.
2.Johnston SC et al., *Neurology.* 2003;60(9):1429-1434.

EPIDEMIOLOGY

VARIATIONS DUE TO AGE AND RACE-ETHNICITY

- **TIA incidence markedly increases with age and varies by race-ethnicity.**
- **TIA prevalence rates vary depending on the age distribution of the study population.**

VARIATIONS IN DIAGNOSIS

Variability in the utilization of brain imaging and the type of diagnostic imaging markedly affects estimates of the incidence and prevalence of TIAs.

EPIDEMIOLOGY

PREVALENCE OF PRIOR TIA IN PATIENTS WITH STROKE

Prevalence of prior TIA ranges from 7% to 40%, among patients who present with stroke. [11,12]

Percentage varies depending on

- **how TIA is defined**
- **stroke subtypes are evaluated, and**
- **whether the study is a population-based series or a hospital-based series**

11. Dennis M et al., *Stroke.* 1990;21(6):848-853.
12. Bogousslavsky J et al ., *Stroke.* 1988;19(9):1083-1092.

DEFINITION

- **Traditional definition: TIAs were operationally defined as any focal cerebral ischemic event with symptoms lasting less than 24 hours.**

- **New tissue-based, rather than time-based, definition proposed in 2002.** [20]

  a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction.

20.Albers GW et al., *N Engl J Med.* 2002;347(21):1713-1716.

Arguments in favor of the new definition

1. A 24-hour duration of symptoms does not accurately demarcate patients with and without tissue infarction (Class III, Level of Evidence A).

   The 24-symptom duration rule misclassifies up to one-third of patients who have actually experienced underlying tissue infarction as not having suffered tissue injury.

Arguments in favor of the new definition

2. **24-hour maximum duration has the potential to delay the initiation of effective stroke therapies (Class I, Level of Evidence C).**

   Patients with deficits lasting one hour or more are highly likely to develop permanent deficits unless an effective therapy is initiated.

3. **The frequency distribution of durations of transiently symptomatic cerebral ischemic events shows no special relationship to the 24-hour time point (Class III, Level of Evidence A).**

   Consideration of symptom durations alone, regardless of association with underlying tissue injury, provides no indication that the 24-hour time point is of any special significance.

Arguments in favor of the new definition

4. A tissue-based definition of TIA will direct diagnostic attention to identifying the cause of ischemia and whether brain injury occurred (Class IIa, Level of Evidence C).

Tissue-based definitions are the rule for ischemic injuries affecting other end organs. For example, distinguishing angina from myocardial infarction

A tissue-based definition of TIA encourages use of neuro diagnostic tests to identify brain injury and its vascular genesis.

Arguments against the new definition

1. **Diagnostic tests play a key role to identify if there is evidence of brain infarction. This will vary depending on the availability of imaging resources.**

    Imaging currently plays a central role in both determining the etiology of, and classifying, acute cerebrovascular syndromes (Class I, Level of Evidence A)

2. **The new definition will modestly alter stroke and TIA prevalence and incidence rates**, but these changes are to be encouraged, as they reflect increasing accuracy of diagnosis (Class IIa, Level of Evidence C).

Arguments against the new definition

3. **Primary care physicians may be confused , whether to designate a presumed transient event of brain ischemia a "stroke" or "TIA"** if they do not have immediate access to neuro imaging or other diagnostic resources

4. **"cerebral infarction with transient symptoms (CITS)" or "transient symptoms with infarction (TSI)" suggested to describe events that last < 24 hours but are associated with cerebral infarction, retaining the 24- hour time threshold in syndrome definition.**

 However, there is no evidence to support incorporation of any particular time criterion for CITS or TSI.

Arguments against the new definition

5. The one- hour time point, like the 24-hour time point, does not accurately distinguish between patients with or without acute cerebral infarction.

It is impossible to define a specific time cut-off that can distinguish whether a symptomatic ischemic event will result in brain injury with high sensitivity and specificity (Class III, Level of Evidence A).

AHA-Endorsed Revised Definition of TIA

Transient ischemic attack (TIA): a transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction.

The Writing Committee found that the key elements of the 2002 Working Group's proposed definition are well supported by the data in the literature. However, the reference to a one-hour time point was not helpful, as the one-hour time point does not demarcate events with and without tissue infarction.

URGENCY

SHORT TERM STROKE RISK:

- Most studies find risks of stroke exceeding 10% in 90 days after TIA.[4, 11, 19, 50-59]

- One-quarter to one-half of strokes that occur within three months occur within the first two days.[11, 19, 50, 54, 57, 59, 60]

- Ischemic stroke carries a lower three-month risk of subsequent ischemic stroke ranging from 4% to 8%.[54-56, 58]

- Risk of cardiac events is also elevated after TIA.

These findings underscore the need for prompt evaluation and treatment of patients with symptoms of ischemia.

RISK STRATIFICATION

- **The California score and the ABCD score both predict short-term risk of stroke well in independent populations of patients presenting acutely after a TIA.[64]**

- **The newer ABCD² score provides a more robust prediction standard and incorporates elements from both the prior scores.[64]**

- **MRI changes have been associated with the clinical factors identified in prior prediction rules,[34] so it is unclear how much they will add to validated prediction rules, such as ABCD².**

ABCD² SCORE

SCORE	FACTORS
1	**A**ge ≥ 60 years
1	**B**lood pressure ≥140/90 mmHg on first evaluation
2 1	**C**linical symptoms of focal weakness with the spell (or) speech impairment without weakness
2 1	**D**uration ≥ 60 minutes (or) 10 to 59 minutes
1	**D**iabetes

STROKE RISK USING ABCD^2 SCORE

Two-day risk of stroke in combined validation cohorts

ABCD^2 SCORE	STROKE RISK
0 - 1	0%
2 - 3	1.3%
4 - 5	4.1%
6 - 7	8.1%

No randomized trial has evaluated the utility of the ABCD^2 score in assisting with triage decisions

HOSPITALIZATION

- **Hospitalization rates after TIA vary widely among practitioners, hospitals, and regions**

- **Close observation during hospitalization has the potential to allow more rapid and frequent administration of tPA should a stroke occur.**

- **Other benefits: cardiac monitoring , rapid diagnostic evaluation, greater rates of adherence to secondary prevention interventions.[68]**

  No randomized trial has evaluated the benefit of hospitalization

DIAGNOSTIC EVALUATION

- **MRI, including diffusion sequences, should be considered a preferred diagnostic test in the investigation of the patient with potential TIAs.**

- **MRI permits confirmation of focal ischemia as the cause of a patient's deficit, improves accuracy of diagnosis of the vascular localization and etiology of TIA, and assesses the extent of pre-existing cerebrovascular injury.**

- **Vessel imaging, cardiac evaluation, and laboratory testing, should be completed according to the AHA acute stroke guidelines.[69]**

CLASS I RECOMMENDATIONS

1. **Patients with TIA should preferably undergo neuroimaging evaluation within 24 hours of symptom onset. MRI, including DWI, is the preferred brain diagnostic imaging modality. If MRI is not available, head CT should be performed (Class I, Level of Evidence B).**

2. **Noninvasive imaging of the cervicocephalic vessels should be performed routinely as part of the evaluation of patients with suspected TIAs (Class I, Level of Evidence A).**

CLASS I RECOMMENDATIONS

3. **Noninvasive testing of the intracranial vasculature** reliably excludes the presence of intracranial stenosis (Class I, Level of Evidence A) and is reasonable to obtain when knowledge of intracranial steno-occlusive disease will alter management. Reliable diagnosis of the presence and degree of intracranial stenosis requires the performance of catheter angiography to confirm abnormalities detected with noninvasive testing.

4. Patients with suspected TIA should be **evaluated as soon as possible after an event** (Class I, Level of Evidence B).

CLASS II RECOMMENDATIONS

1. **Initial assessment of the extracranial vasculature may involve any of the following: carotid ultrasound/TCD, MRA or CTA, depending on local availability and expertise, and characteristics of the patient (Class IIa, Level of Evidence B).**

2. **If only noninvasive testing is performed prior to endarterectomy, it is reasonable to pursue two concordant noninvasive findings; otherwise catheter angiography should be considered (Class IIa, Level of Evidence B).**

CLASS II RECOMMENDATIONS

3. **The role of plaque characteristics and detection of microembolic signals is not yet defined** (Class IIb, Level of Evidence B).

4. **Electrocardiography** should occur as soon as possible after TIA (Class I, Level of Evidence B). Prolonged cardiac monitoring (inpatient telemetry or Holter monitor) is useful in patients with an unclear etiology after initial brain imaging and electrocardiography (Class IIa, Level of Evidence B).

CLASS II RECOMMENDATIONS

5. Echocardiography (at least TTE) is reasonable in the evaluation of patients with suspected TIAs, especially when the patient has no cause is identified by other elements of the work-up (Class IIa, Level of Evidence B). TEE is useful in identifying patent foramen ovale, aortic arch atherosclerosis, and valvular disease and is reasonable when identification of these conditions will alter management (Class IIa, Level of Evidence B).

6. Routine blood tests (complete blood count, chemistry panel, prothrombin time and partial thromboplastin time, and fasting lipid panel) are reasonable in the evaluation of patients with suspected TIAs (Class IIa, Level of Evidence B).

CLASS II RECOMMENDATIONS

7. It is reasonable to hospitalize patients with TIA if they present within 72 hours of the event and any of the following criteria are present:

- ABCD² score of ≥3, (Class IIa, Level of Evidence C).

- ABCD² score of 0-2 and uncertainty that diagnostic work-up can be completed within 2 days as an outpatient (Class IIa, Level of Evidence C).

- ABCD² score of 0-2 and there is other evidence that indicates the patient's event was caused by focal ischemia (Class IIa, Level of Evidence C).

Optional coagulation screening tests

In younger patients with TIAs, particularly when no vascular risk factors exist and no underlying etiology is identified

- Protein C, Protein S, antithrombin III activities
- Activated protein C resistance/factor V Leiden
- Fibrinogen
- D-Dimer
- Anticardiolipin antibody
- Lupus anticoagulant
- Homocysteine

- Prothrombin gene G20210A mutation
- Factor VIII
- Von Willebrand factor
- Plasminogen activator inhibitor-1
- Endogenous tissue plasminogen activator activity

Table 1. Applying Classification of Recommendations and Level of Evidence

SIZE OF TREATMENT EFFECT →

	CLASS I *Benefit >>> Risk* **Procedure/Treatment SHOULD** be performed/administered	**CLASS IIa** *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	**CLASS IIb** *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	**CLASS III** *Risk ≥ Benefit* **Procedure/Treatment should NOT** be performed/administered **SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL**
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations†	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	is not recommended is not indicated should not is not useful/effective/beneficial may be harmful

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT