CLINICAL PROGRESS AND PROGNOSIS IN TRANSIENT ISCHEMIC ATTACK (TIA): INSIGHTS FROM CONTEMPORARY EVIDENCE

Aiperi Almanbekova[1]
[1]Neurology Resident, Helios Clinic Pforzheim, Germany

Abstract
Transient ischemic attack (TIA) serves as a critical warning for ischemic stroke, with recent advances in rapid evaluation and secondary prevention significantly altering its prognosis. This comprehensive narrative review synthesizes evidence from studies published between 2020 and 2025, highlighting reductions in short-term stroke risk due to urgent management protocols, while emphasizing persistent long-term risks. Key prognostic factors include diffusion-weighted imaging (DWI) positivity, large-artery atherosclerosis, cardioembolic etiology, and clinical variables such as age and diabetes. Contemporary short-term (90-day) stroke risks range from 1–6% in optimized settings, contrasting with historical rates of 10–20%. Long-term (5–10 year) risks remain elevated at 9–15%, underscoring the need for sustained prevention. Imaging and etiologic stratification emerge as pivotal for risk prediction beyond traditional clinical scores. Clinical implications focus on multimodal assessment and personalized therapy to mitigate recurrence.

Keywords: Transient ischemic attack, prognosis, stroke recurrence, prognostic factors, neuroimaging

КЛИНИЧЕСКИЙ ПРОГРЕСС И ПРОГНОЗ ПРИ ТРАНЗИТОРНОЙ ИШЕМИЧЕСКОЙ АТАКЕ (ТИА): ВЫВОДЫ ИЗ СОВРЕМЕННЫХ ДАННЫХ

Айпери Альманбекова[1]
[1]Ординатор-невролог, клиника «Гелиос», Пфорцхайм, Германия

Аннотация
Транзиторная ишемическая атака (ТИА) является критическим предупреждающим сигналом о возможном ишемическом инсульте, а недавние достижения в быстрой оценке и вторичной профилактике значительно меняют ее прогноз. Этот всесторонний обзор обобщает данные исследований, опубликованных в период с 2020 по 2025 год, подчеркивая снижение краткосрочного риска инсульта благодаря протоколам неотложного лечения, и акцентируя внимание на сохраняющихся долгосрочных рисках. Ключевые прогностические факторы включают положительный результат диффузионно-взвешенной магнитно-резонансной томографии (ДВМРТ), атеросклероз крупных артерий, кардиоэмболическую этиологию и клинические переменные, такие как возраст и диабет. Современные краткосрочные (90-дневные) риски инсульта составляют от 1 до 6% в оптимизированных условиях, в отличие от исторических показателей в 10–20%. Долгосрочные (5–10 лет) риски остаются повышенными на уровне 9–15%, что подчеркивает необходимость постоянной профилактики. Визуализация и этиологическая стратификация играют ключевую роль в прогнозировании риска, выходя за рамки традиционных клинических шкал. Клинические аспекты сосредоточены на мультимодальной оценке и персонализированной терапии для снижения риска рецидива.

Ключевые слова: транзиторная ишемическая атака, прогноз, рецидив инсульта, прогностические факторы, нейровизуализация

 Correspondence: Neurology Resident, Helios Clinic Pforzheim, Germany, Email: aiperialmanbekova@gmail.com

Introduction

Transient ischemic attack (TIA) is characterized by a brief episode of neurological dysfunction [1,2] due to focal cerebral, spinal, or retinal ischemia, without evidence of acute infarction on imaging (tissue-based definition) [3,4] or symptoms resolving within 24 hours (time-based definition, now largely superseded) [5]. TIA represents a harbinger of ischemic stroke, with approximately 240,000 cases annually in the United States alone [6].

Historical data indicated high short-term risks, with 90-day stroke rates of 10–20%, half within the first 48 hours [1]. However, contemporary cohorts demonstrate substantial risk reduction attributable to urgent evaluation pathways and evidence-based interventions, such as short-term dual antiplatelet therapy [2,7]. Despite these gains, long-term prognosis remains guarded, with ongoing risks driven by underlying vascular pathologies and comorbidities [3,4].

This narrative review examines progress in TIA prognosis based on evidence from 2020–2025, focusing on short- and long-term outcomes, key prognostic factors (clinical, imaging, etiologic), and implications for practice. It highlights how tissue-based definitions and multimodal risk stratification have refined prognostication [8,9]

Epidemiology and Contemporary Management

The incidence of TIA varies by population, but recent estimates suggest stable or slightly declining rates due to improved primary prevention of atherosclerosis and atrial fibrillation detection [6]. Fast-track care models, emphasizing evaluation within 24 hours, have proven effective in mitigating early recurrence. Studies from this period consistently show that organized TIA clinics reduce 90-day stroke risks by 70–80% compared to historical controls [2,10].

Short-Term Prognosis

In modern practice with rapid assessment, short-term stroke risk after TIA has declined markedly. Contemporary cohorts report 90-day risks of 1–6%, a stark contrast to pre-2010 figures [2,11]. This improvement stems from protocols including immediate brain imaging (preferably MRI), vascular studies (CTA/MRA), cardiac monitoring, and initiation of antiplatelet therapy or anticoagulation as indicated [7,12].

For instance, registries incorporating urgent management show risks as low as 2–4% at 90 days [2]. Even in tissue-negative cases, risks are not negligible, ranging 3–5% [13]. High-risk features, such as symptomatic stenosis or atrial fibrillation, warrant hospitalization and intensive intervention [14].

Long-Term Prognosis

While short-term risks have diminished, long-term outcomes reveal persistent vulnerability. Five-year stroke risks in recent cohorts approximate 9–12%, with cumulative rates reaching 15–20% at 10 years [3,4]. Composite vascular events (stroke, myocardial infarction, vascular death) affect 20–30% over extended follow-up.

Data from large prospective registries confirm 5-year stroke incidence around 9.6–10%, lower than older estimates but still substantial [3]. A 2025 analysis highlighted enduring risks, with cumulative stroke probabilities of approximately 6–10% at 5 years and ongoing annual hazards of 1–2% [4]. Factors contributing to this persistence include incomplete adherence to secondary prevention, progression of atherosclerosis, and undetected paroxysmal arrhythmias [15].

Prognostic Factors

Clinical Factors

Traditional risk scores remain foundational. The ABCD2 score has been augmented by ABCD3-I (adding dual TIA and imaging findings). Recent validations (2020–2025) affirm ABCD3-I's superiority for short-term prediction, with c-statistics of 0.70–0.80 [16,17]. Emerging tools like the Canadian TIA Score show promise in ongoing studies [18].

Individual factors consistently associated with worse outcomes include advanced age (>60 years, HR 1.5–2.2), diabetes (HR 1.4–2.0), hypertension, prior TIA/stroke, and symptomatic duration >60 minutes [11,19]. Nonfocal symptoms or bilateral events may signal higher coronary risk [20].

• *Table1: Clinical factor with approximate hazard ratio*

Clinical Factor	Approximate Hazard Ratio (Recurrent Stroke)	Time Frame
Age >60 years	1.5–2.2	Short- and long-term [11]
Diabetes mellitus	1.4–2.0	Long-term predominant [19]
Hypertension	1.3–1.8	Both [11]
Prior TIA/stroke	1.8–3.0	Both [14]
High ABCD3-I score (⩾6)	3.0–5.0	Short-term [16]

Imaging Factors

Diffusion-weighted MRI (DWI) has revolutionized prognostication. DWI-positive lesions, present in 30–40% of clinically defined TIAs, reclassify events as minor strokes and confer markedly higher risks (HR 3–6 for early recurrence; 2–4 long-term) [9,13]. Multiple lesions or large infarcts amplify this further [21]. Conversely, DWI-negative TIA is not benign: recent studies (2024–2025) report clinically significant recurrent event rates (4–8% at 1 year; 10–15% at 5 years) [13]. Vessel imaging reveals ipsilateral stenosis (⩾50%) as a strong predictor (HR 2.5–4.0), guiding revascularization decisions [14].

Table 2: Imaging factor with approximate hazard ratio

Imaging Factor	Approximate Hazard Ratio	Consistency Across Studies
DWI-positive	3.0–6.0 (short-term); 2.0–4.0 (long-term)	High [9,13]
Ipsilateral stenosis ⩾50%	2.5–4.0	High [14]
Multiple DWI lesions	4.0–7.0	Moderate [21]

Etiologic and Biomarker Factors

TOAST classification informs prognosis profoundly. Cardioembolic sources (e.g., atrial fibrillation) and large-artery atherosclerosis carry the highest risks (HR 2.5–3.5), driven by embolic potential and plaque instability [14,22]. Small-vessel disease confers lower recurrence but higher disability risk. Undetermined etiology, often cryptogenic, has intermediate prognosis but benefits from prolonged monitoring [23].

Biomarkers such as elevated troponin or inflammatory markers show associative evidence but limited incremental predictive value in recent cohorts [24].

• *Table 3: Etiologic subtype with approximate hazard ratio*

Etiologic Subtype	*Approximate Hazard Ratio (vs. Small-Vessel)*	*Key Mechanism*
Cardioembolic	2.5–3.5	Embolic showers [14]
Large-artery atherosclerosis	2.0–4.0	Plaque rupture/instability [22]
Undetermined/cryptogenic	1.5–2.5	Variable [23]

Biological Mechanisms

Progression after TIA involves plaque vulnerability (large-artery), thromboembolic cascades (cardioembolic), and endothelial/microvascular dysfunction (small-vessel) [22]. Chronic inflammation, oxidative stress, and comorbidity-driven acceleration (e.g., diabetes-induced atherogenesis) sustain long-term risks. DWI lesions reflect irreversible injury, explaining heightened recurrence via unstable substrates [9].

Clinical Implications

All TIA patients require urgent multimodal evaluation: MRI-DWI, vessel imaging, prolonged cardiac rhythm monitoring, and etiology-directed therapy [5,12]. High-risk features (DWI+, stenosis, cardioembolism) mandate intensive measures—dual antiplatelets for 21–90 days in non-cardioembolic cases, early carotid intervention, or prompt anticoagulation [7].

Long-term management emphasizes lifelong risk factor control (BP <130/80 mmHg, LDL <70 mg/dL, glycemic targets, smoking cessation) and adherence support [15]. Integrated scores combining clinical, imaging, and etiologic data outperform standalone tools [16].

Future Directions and Conclusion

Emerging areas include artificial intelligence for risk modeling, novel biomarkers, and extended rhythm monitoring for cryptogenic cases [25]. Gaps persist in low-resource settings and diverse populations.

In summary, 2020–2025 evidence marks remarkable progress in short-term TIA prognosis through structured care, with risks now typically <5% at 90 days [2]. However, long-term stroke risks of 9–15% over 5–10 years demand vigilant, personalized prevention [3,4]. Prioritizing neuroimaging and etiologic classification enhance stratification, guiding therapies to minimize recurrence and optimize outcomes.

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