



Stroke: From Door to Needle and Thrombolytic Therapy

Updated to AHA/ASA 2026 · with the European (ESO) comparison

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The dose

A 62-year-old man (80 kg) arrives 2 hours after the onset of right hemiparesis and aphasia — a disabling deficit. CT shows no haemorrhage. You choose tenecteplase. What do you give?

A 20 mg (4 mL) as a single IV bolus

B 40 mg (8 mL) as a single IV bolus

C 72 mg: 7.2 mg bolus, then 64.8 mg over 60 min

D 25 mg (5 mL) — the fixed stroke dose

Answer at the end of the lecture

The clock

A 70-year-old woman was last known well 7 hours ago. NIHSS 9, disabling. CT: no haemorrhage. CTA: no large vessel occlusion. Automated CT perfusion: core 12 mL, penumbra 55 mL. Best next step?

A No reperfusion — she is beyond 4.5 hours

B IV thrombolysis

C Mechanical thrombectomy

D Repeat imaging with MRI before deciding

Answer at the end of the lecture

The mild stroke

A 55-year-old man presents 90 minutes after mild numbness of the left face and arm. NIHSS 2. He walks, works and manages daily tasks normally. CT and CTA are normal. Best treatment?

A Alteplase 0.9 mg/kg

B Tenecteplase 0.25 mg/kg

C Aspirin + clopidogrel (dual antiplatelets)

D Full-dose heparin

Answer at the end of the lecture

Overview of Stroke

1. Global Impact

Stroke is a leading cause of death and disability worldwide, with approximately 15 million people affected annually.

2. Ischemic Strokes

Ischemic strokes account for about 87% of all strokes.

3. Time-Sensitive

The phrase 'time is brain' emphasizes the critical need for rapid assessment and treatment.

4. Early Intervention

Early intervention can significantly improve patient outcomes and reduce long-term disability.

5. Pre-Hospital Management

Stroke management starts pre-hospital.

What Changed in 2026

AHA/ASA 2026 guideline for acute ischaemic stroke — the first full rewrite since 2018

01

Tenecteplase = alteplase

TNK 0.25 mg/kg (max 25 mg) or alteplase 0.9 mg/kg within 4.5 h — both Class 1.

02

Up to 9 hours

IVT at 4.5–9 h, or ≤ 9 h from mid-sleep, if automated perfusion shows penumbra (Class 2a).

03

Disabling, not a number

Treat a disabling deficit at any NIHSS. Mild non-disabling → DAPT, not IVT (Class 3).

04

Thrombectomy widened

Large core (ASPECTS 3–5) and basilar occlusion with NIHSS ≥ 10 , within 24 h — Class 1.

05

Don't over-lower BP

SBP < 140 after successful thrombectomy: Class 3, Harm. Keep $< 180/105$ for 24 h.

06

Faster systems

Mobile stroke units Class 1. Don't wait for creatinine before CTA/CTP (Class 1).

Discovering the Etymology of Stroke

The term "stroke" comes from the Middle English "strok" — "a blow", the same root as "strike". The medical sense, "a stroke of God's hand", appears in the late 1500s. This reflects the sudden nature of a stroke, often felt like being struck by something unexpected. Additionally, in the medical context, the Latin term "ictus" was used, meaning "a blow" as well, highlighting how quickly a stroke can take effect. Imagine a person, let's say 58 years old, who experiences a stroke out of nowhere while at a family gathering—this sudden incident can leave everyone in shock. Understanding this history helps illustrate the abrupt and impactful experience of a stroke.

Dictionary

Definitions from [Oxford Languages](#) · [Learn more](#)



stroke

noun

1. an act of hitting or striking someone or something; a blow.

"he received three strokes of the cane"

Similar:

blow

hit

thump

thwack



2. a mark made by drawing a pen, pencil, or paintbrush in one direction across paper or canvas.

"the paint had been applied in careful, regular strokes"

Similar:

mark

line

slash

solidus



verb

1. move one's hand with gentle pressure over (a surface), typically repeatedly; caress.

"he put his hand on her hair and stroked it"

Similar:

caress

fondle

pat

pet



2. act as the stroke of (a boat or crew).

"he stroked the coxed four to victory"

Defining Stroke According to Leading Institutions

Evidence-Based Insights from Renowned Medical Sources

What is Stroke?

A stroke occurs when blood flow to the brain is interrupted by a blockage or burst blood vessel. This can lead to brain damage and impaired bodily functions. For example, a hospital report might state that 15% of patients experience long-term complications after a stroke.

Impact of Stroke

According to the World Health Organization, strokes are a leading cause of death globally, affecting approximately 15 million people each year. Of these, nearly 5 million do not survive, highlighting the urgent need for awareness and prompt medical response.

Types of Stroke

Strokes are categorized into two main types: ischemic and hemorrhagic. Ischemic strokes, caused by blockages, account for about 87% of all strokes. Hemorrhagic strokes occur when a blood vessel ruptures. Understanding these types is crucial for timely treatment.

Stroke Risk Factors

Common risk factors include high blood pressure, diabetes, and smoking. For instance, studies show that individuals with untreated high blood pressure are three times more likely to experience a stroke. Managing these factors can significantly reduce stroke risk.

Role of Emergency Medical Services (EMS)

BE-FAST Acronym

EMS uses the BE-FAST acronym for early recognition of stroke symptoms: Balance abnormalities, Eyes (visual problems), Face drooping, Arm weakness, Speech difficulties, and Time to call emergency services.

Rapid Pre-Notification

Pre-notification to the receiving hospital allows for rapid stroke team activation.

Transport Protocol

2026: take the patient to the closest appropriate stroke-capable hospital. If a large vessel occlusion is suspected (e.g., RACE > 4) and a thrombectomy centre is within reach — or fast transfer is not available — go direct. Mobile stroke units are now Class 1.

Emergency Department Care and Stroke Specialty Guidance

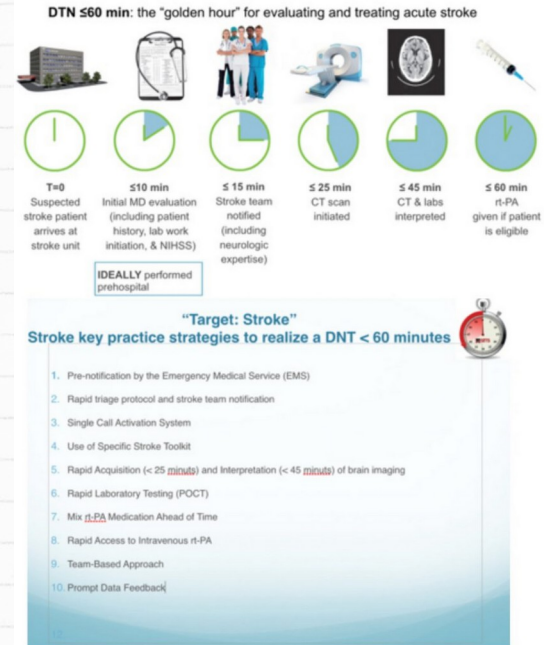
When a patient arrives in the emergency department with stroke symptoms, every second counts. The team should quickly activate a stroke code and prepare for a rapid evaluation. Key assessments include obtaining a history of symptoms and conducting a focused neurological examination within minutes. For example, a fictional patient showing signs of weakness might receive a NIHSS score calculated in under 10 minutes. Stroke specialists should be consulted early to guide treatment decisions and ensure the latest protocols are followed. For instance, specialists may recommend a CT scan and quick thrombolytic therapy if the patient meets the criteria, aiming to improve recovery chances significantly.

▶▶▶ Box 2. Initial In-Hospital Evaluation Key Points

- ✓ Deploy a team using a standard protocol to evaluate possible stroke
- ✓ Door-to-needle time for thrombolytic treatment ≤ 45 min for $\geq 50\%$ of eligible patients
- ✓ Consider use of telestroke services that includes teleradiology
- ✓ Obtain head CT in ≤ 20 minutes for $\geq 50\%$ of eligible patients to rule out intracranial hemorrhage
- ✓ MRI to rule out microbleeds is NOT recommended

Initial Evaluation in the Emergency Department (ED)

Rapid Triage and Stroke code Activation. Upon arrival, patients should be triaged quickly to minimize delays. The stroke team should be activated immediately. Initial assessment includes the ABCDE approach with stabilizing the patient first, followed by RBS checking.



Neurological Assessment

NIH Stroke Scale (NIHSS)

Developed by Brott and colleagues in Cincinnati (1989) and used as the primary scale of the NINDS rt-PA trial (1995). Lyden and colleagues later standardised training and published the shorter modified NIHSS (2001).

Scoring

Total scores range from 0 (no deficit) to 42 (most severe). In 2026 the decision to thrombolyse rests on whether the deficit is disabling — not on a cut-off score.



Is Creatinine Level Essential Before CT Angiography in Hyperacute Stroke?

Guidelines

- American College of Radiology (ACR): Recommends assessing renal function before contrast administration, especially in patients with risk factors for CIN.
- European Society of Cardiology (ESC): Emphasizes assessing renal function before procedures involving contrast media.

Additional Considerations

Renal impaired (RI) patients have higher risks for reperfusion injury and intracerebral hemorrhage. Communication must be established and documented in patients with known RI, and efforts made to improve renal function in unknown cases before proceeding with time-sensitive treatment.

Key Findings

- Low incidence (2.9%) of CIN in acute stroke patients without prior renal dysfunction; no cases required dialysis or progressed to renal failure.
- Many patients with acute stroke can proceed to CT angiography without prior creatinine levels if they have no known renal impairment.
- Higher risk for CIN in patients with chronic kidney disease or diabetes mellitus. Creatinine levels should be assessed prior to contrast administration.

Conclusion

- AHA/ASA 2026 (Class 1): in suspected LVO, contrast CTA and/or CTP should not be delayed to obtain serum creatinine.
- Check creatinine afterwards; flag known CKD to the team and hydrate.

Neuroimaging Protocol

Non-Contrast CT Head

First test: rules out haemorrhage and shows early ischaemia — dense MCA sign, dot sign, insular ribbon sign, basal ganglia asymmetry, loss of grey–white boundary, cortical hypodensity (score with ASPECTS).

CT Angiography (CTA)

Identifies large vessel occlusion (ICA, M1, M2, basilar) and plans thrombectomy. CTA or MRA — both Class 1, LOE A; CTA wins on speed and availability.

MRI & Perfusion

DWI is the most sensitive test for acute ischaemia. DWI–FLAIR mismatch selects wake-up strokes; CT or MR perfusion selects the 4.5–9 h window and late thrombectomy. Within 4.5 h, never delay treatment for it.

Historical Overview of Thrombolytic Therapy

Pioneering Research

- 1933: Tillett and Garner discovered that certain streptococcus strains could dissolve fibrin clots.
- 1955: Tillett reported clinical effectiveness of streptokinase in patients with vascular thrombi.
- 1940s: Macfarlane and Pilling described fibrinolytic potential of human urine, leading to urokinase extraction.

Early Clinical Use

1958: Sussman and Fitch treated 3 patients with intravenous plasmin for acute ischemic stroke but early studies showed increased risk of intracranial hemorrhage and lack of efficacy.

Modern Developments

- 1979: Discovery of tissue plasminogen activator (t-PA).
- 1983: Production of recombinant t-PA (rt-PA).
- 1995: NINDS trial — alteplase effective within 3 hours.
- 2008: ECASS III extends the window to 4.5 hours.
- 2026: AHA/ASA — tenecteplase equal to alteplase.

The Innovative Thrombolysis Concept by Tillett and Garner

In 1933, researchers Tillett and Garner made a groundbreaking discovery that would change the course of stroke treatment. They found that certain strains of streptococcus bacteria could dissolve fibrin clots, a crucial step in thrombolysis therapy. This concept opened doors to developing treatments for conditions where blood clots blocked vital arteries. In 1955, Tillett and colleagues gave intravenous streptokinase, derived from these bacteria, to patients for the first time. This pioneering work laid the foundation for future thrombolytic therapies, demonstrating that directly targeting clots could significantly improve patient outcomes in acute situations, ultimately revolutionizing the way we approach stroke care.



Mechanism of Action of Alteplase

Overview

Alteplase, or recombinant tissue plasminogen activator (rt-PA), is a thrombolytic agent used to treat acute ischemic stroke by activating the conversion of plasminogen to plasmin, degrading fibrin, and dissolving the thrombus.

Steps

1. Alteplase binds to fibrin in the thrombus.
2. This enhances its activation of plasminogen to plasmin.
3. Plasmin degrades the fibrin mesh, dissolving the clot.
4. Alteplase has a higher affinity for fibrin-bound plasminogen, increasing fibrin specificity.

Tenecteplase: tPA Re-engineered

Three mutations of alteplase — T, N and K — give the drug its name

T103N

Adds a glycosylation site → slower clearance

14×

more fibrin-specific than alteplase — less systemic fibrinogen depletion

N117Q

Removes a glycosylation site → less hepatic clearance

~20 min

initial half-life (alteplase < 5 min) — so one bolus, no infusion

KHRR → AAAA

At 296–299 → about 80× more resistant to PAI-1

5 s

single IV bolus — easier for drip-and-ship and transfer

Same mechanism as alteplase: binds fibrin and converts plasminogen to plasmin, which breaks down the clot.

Tenecteplase in Practice

Dose, evidence and the one mistake to avoid

0.25 mg/kg

single IV bolus over 5 seconds · maximum 25 mg

Volume (mL) = weight (kg) ÷ 20
vial 5 mg/mL · never more than 5 mL

One vial, two doses

The cardiac dose is about 0.5 mg/kg (30–50 mg). Draw up only the stroke dose and discard the rest. TNK 0.4 mg/kg is not recommended (Class 3).

Trials against alteplase

Trial	Result
AcT · Lancet 2022	Non-inferior
TRACE-2 · Lancet 2023	Non-inferior
ATTEST-2 · Lancet Neurol 2024	Non-inferior
ORIGINAL · JAMA 2024	Non-inferior
EXTEND-IA TNK · NEJM 2018	More reperfusion before thrombectomy (22% vs 10%)

Same contraindications, BP targets and monitoring as alteplase; symptomatic ICH rates similar.

Benefits of Thrombolytic Therapy



Decreased Mortality and Morbidity

Generally decreases mortality and morbidity in stroke patients by dissolving the clot and restoring blood flow.

Therapeutic Window

When given within the therapeutic window, it can reduce long-term disability and improve quality of life.

Risks of Thrombolytic Therapy in Acute Ischemic Stroke

Intracerebral Hemorrhage

Symptomatic ICH is the most serious complication: about 6% with alteplase vs 0.6% with placebo in the NINDS trial. Rates with tenecteplase are similar.

Other Complications

Systemic bleeding (2%), Orolingual angioedema (1–5%, more with ACE inhibitors), Reperfusion injury, Urinary tract infection and pneumonia, Worsening stroke severity, longer hospital stay, In-hospital mortality, Disability at discharge.

Risks of Thrombolytic Therapy in AIS

- - ICH remains the most serious complication with 6% compared to 1% in untreated patients.
- - Systemic bleeding 2%.
- - Angioedema 5% especially if associated with ACE inhibitors.
- - Reperfusion injury.
- - Urinary tract infection and pneumonia.
- - Worsening stroke severity and longer hospital stay.
- - In-hospital mortality.
- - Disability at discharge.

Contraindications to Thrombolysis

▶▶▶ Box 3. Thrombolytic Administration Key Points

- ✓ t-PA can be given within 3-4.5 hours of symptom onset
- ✓ Administration of t-PA should NOT be delayed
- ✓ t-PA benefits are not age or stroke-severity dependent
- ✓ Adjuvant treatment with sonothrombolysis is not recommended and does not have clinical benefit
- ✓ The following are NOT contraindications to t-PA:
 - ✓ Combined history of diabetes and stroke
 - ✓ Use of warfarin (INR <1.7)
 - ✓ Mild but disabling stroke symptoms
 - ✓ Extracranial cervical arterial dissections
 - ✓ Cortical microbleeds ≤ 10 total
 - ✓ Unruptured unsecured intracranial aneurysms ≤ 10 mm in size
- ✓ Intra-axial intracranial neoplasms are a contraindication to t-PA
- ✓ There is potential harm from t-PA for patients with a history of intracranial hemorrhage
- ✓ Maintain BP <185/110 before t-PA administration to reduce risk of hemorrhage
- ✓ Maintain BP <180/105 for 24 hours after t-PA administration to reduce risk of hemorrhage

Absolute contraindications include prior intracranial hemorrhage, known structural cerebral vascular lesion, known malignant intracranial neoplasm, ischemic stroke within the previous 3 months, recent intracranial or spinal surgery (within 3 months), acute bleeding diathesis, and recent major surgery or serious trauma. Relative contraindications include rapidly improving symptoms, a DOAC within 48 hours (unless drug-specific tests are normal), seizure at onset, recent gastrointestinal or urinary tract hemorrhage, and others. A mild, non-disabling deficit is no longer a 'relative' issue: do not thrombolyse (Class 3).

Understanding Absolute Contraindications of Thrombolysis

Thrombolysis is a critical treatment for stroke, but there are some absolute contraindications that prevent its use to ensure patient safety. These include having a history of prior intracranial hemorrhage—imagine if a patient had a previous brain bleed; using thrombolysis could be too risky. Other serious conditions, like known structural brain issues or recent major surgeries, also make thrombolysis inadvisable. For instance, if someone had surgery on their brain within the last three months, thrombolysis should be avoided. Always, patient safety comes first, and understanding these contraindications helps healthcare providers make the best decisions for their patients.

Absolute Contraindications to Thrombolytic Therapy in STEMI

- Prior intracranial hemorrhage
- Known structural cerebral vascular lesion (e.g. arteriovenous malformation)
- Known malignant intracranial neoplasm (primary or metastatic)
- Severe uncontrolled hypertension (unresponsive to therapy)
- Suspected aortic dissection
- Active bleeding or bleeding diathesis
- Significant closed-head or facial trauma within 3 months
- Ischemic stroke within 3 months
- Intracranial or intraspinal surgery within 2 months
- Prior treatment of streptokinase within the previous 6 months (if received streptokinase within previous 6 months, do NOT use streptokinase due to its highly antigenic nature and potential for a serious allergic reaction)

Understanding Relative Contraindications for Thrombolytic Therapy

Relative contraindications for thrombolytic therapy are situations where the risks may outweigh the benefits, but treatment might still be considered under certain conditions. For example, a patient may have a mild stroke with a National Institutes of Health Stroke Scale (NIHSS) score of 4 and a recent gastrointestinal bleed recorded just two weeks ago. In such cases, medical teams might proceed cautiously, weighing the risk of bleeding against the potential benefits of early treatment. Other examples include patients who have had recent major surgery, such as a hip replacement within the last month, or rapid improvement in stroke symptoms. Always, the aim is to ensure patient safety while considering timely interventions.

Relative Contraindications to Thrombolytic Therapy in STEMI

- Known intracranial pathology not covered in absolute contraindications
- Traumatic or prolonged (>10 min) CPR
- Systolic blood pressure > 180 mmHg or diastolic blood pressure > 110 mmHg upon presentation
- Significant history of chronic, severe, poorly controlled hypertension
- History of prior ischemic stroke that occurred more than 3 months ago
- Dementia
- Pregnancy
- Active peptic ulcer
- Major surgery within 3 weeks prior
- Recent internal bleeding within 4 weeks prior
- Noncompressible vascular punctures
- Oral anticoagulation therapy

Dosing in Acute Ischemic Stroke

Alteplase

0.9 mg/kg · max 90 mg

10% as IV bolus over 1 min, then 90% by infusion over 60 min.

Worked example 70 kg → 63 mg: 6.3 mg bolus + 56.7 mg over 60 min

AHA/ASA 2026: Class 1, LOE A

Tenecteplase

0.25 mg/kg · max 25 mg

Single IV bolus over 5 seconds. Volume (mL) = weight ÷ 20, max 5 mL.

Worked example 70 kg → 17.5 mg = 3.5 mL as one bolus

AHA/ASA 2026: Class 1, LOE A

Use actual body weight. Do not exceed the maximum dose. Tenecteplase 0.4 mg/kg is not recommended (Class 3: No Benefit).

Before Thrombolysing Your Patient, Remember These Steps

Before administering thrombolysis to a patient, several crucial steps must be followed to ensure safety and effectiveness. First, confirm the onset of symptoms—patients presenting within a 4.5-hour window from symptom onset are typically eligible for treatment. Next, ask whether the deficit is disabling — would it stop daily activities or a return to work? The 2026 guideline drops NIHSS cut-offs. Don't forget to review contraindications, like recent major surgery or anticoagulant use. For instance, a patient who had a hip replacement two weeks ago might not qualify. Assessing vital signs and conducting a CT scan to rule out hemorrhage are also essential before moving forward with therapy. Remember, thorough preparation can significantly enhance outcomes!



Pre and Post tPA Care: Frequently Asked Questions

1. Is written informed consent required prior to giving tPA?

tPA is the standard of care, and currently the only approved agent for acute ischemic stroke treatment. Written informed consent is not required but it is advisable to seek oral expressed consent from the patient or substitute decision maker.

2. When can a urinary catheter be inserted after giving tPA?

If required, urinary catheter to straight drainage **prior** to alteplase infusion. If unable to catheterize patient prior to alteplase infusion, wait **4 hours** after infusion then insert.

3. When can an NG be inserted after giving tPA?

NG can be inserted 4 hours after tPA after infusion.

4. When can a TORBBST be done after giving tPA?

TORBBST can be done immediately following the tPA infusion and repeated as frequently as required thereafter.

Thrombolysis Administration and Monitoring

During therapy with Activase

- Perform neurologic assessment every 15 minutes during the 1-hour infusion
- Check for major and/or minor bleeding
- Monitor blood pressure every 15 minutes during the 1-hour infusion
- Monitor for signs of intracranial hemorrhage (ICH)
- Monitor for signs of orolingual angioedema
- Discontinue infusion and obtain an emergency CT scan if the patient develops severe headache, acute hypertension, nausea, or vomiting, or has a worsening neurologic examination

During Treatment

Closely monitor for bleeding and neurological status. Keep BP below 180/105 mmHg — but do not push systolic below 140 (Class 3). Avoid invasive procedures. Have cryoprecipitate ready (tranexamic acid as the alternative).

After Treatment

Continue close monitoring for 24 hours. Repeat head CT at 24 hours or if neurological deterioration occurs. Initiate antithrombotic therapy 24 hours after thrombolysis if no intracerebral hemorrhage is present. Consult neurosurgery for large infarcts or edema.

Monitoring During and After Thrombolytic Therapy

Continue to monitor for neurologic deterioration every 15 minutes for the first hour after cessation of infusion

every 30 minutes for the next 6 hours

every hour from the eighth postinfusion hour until 24 hours after infusion is stopped

Continue to monitor and control blood pressure

every 15 minutes for the first hour after cessation of infusion

every 30 minutes for the next 6 hours

every hour from the eighth postinfusion hour until 24 hours after infusion is stopped

Continue to check for major and/or minor bleeding

Obtain a follow-up CT scan or magnetic resonance imaging (MRI) at 24 hours before starting anticoagulants or antiplatelet agents

Continue to monitor for signs of hypersensitivity

DID YOU KNOW?

- Discontinue infusion and obtain an emergency computed tomography (CT) scan if the patient develops severe headache, acute hypertension, nausea, or vomiting, or has worsening neurologic examination.²

Who Can Benefit from Thrombolysis?

0–4.5 h Disabling deficit, any NIHSS → alteplase or tenecteplase (Class 1). No advanced imaging needed.

Wake-up / unknown onset MRI DWI–FLAIR mismatch, within 4.5 h of recognition (Class 2a).

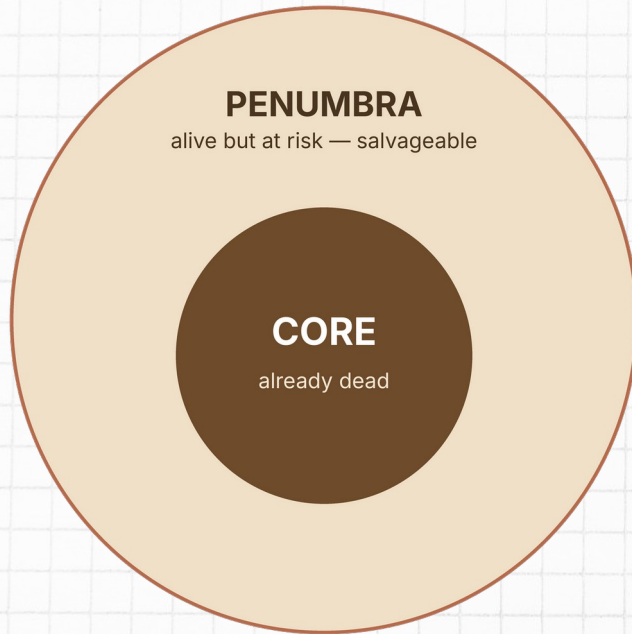
4.5–9 h, or ≤ 9 h from mid-sleep Salvageable penumbra on automated perfusion imaging (Class 2a).

LVO, 4.5–24 h, no thrombectomy possible Penumbra on perfusion; expert centres (Class 2b).

Not a candidate Mild non-disabling deficit → dual antiplatelets instead (IVT: Class 3, No Benefit).

Beyond 4.5 Hours: Is There Penumbra?

After 4.5 h the question is not “how long?” but “what is still alive?”



Automated CTP or MR perfusion

Core < 70 mL · penumbra ≥ 10 mL · mismatch ratio ≥ 1.2 (EXTEND, NEJM 2019)

Wake-up stroke on MRI

DWI lesion < $\frac{1}{3}$ of the MCA territory with no marked FLAIR change (WAKE-UP, NEJM 2018)

The price

Symptomatic ICH 6.2% vs 0.9% in EXTEND — why the guideline says Class 2a, not Class 1

Simplified Steps for Acute Stroke Pathway

1. Pre-hospital

BE-FAST recognition · LVO scale (e.g., RACE) · pre-notify the hospital · mobile stroke unit where available.

2. Hospital arrival

Code Stroke · ABC · glucose · NIHSS · rule out mimics · NCCT + CTA (or MRI/MRA) — don't wait for creatinine.

3. Reperfusion

Disabling deficit ≤ 4.5 h: tenecteplase 0.25 mg/kg bolus or alteplase 0.9 mg/kg, after BP $< 185/110$. LVO → thrombectomy as well; don't skip IVT.

4. After treatment

HDU/ICU · BP $< 180/105$ (not < 140) · neuro checks · CT at 24 h before antithrombotics · cryoprecipitate / TXA at hand.



Pathway designed by Dr Mohamed Najm

What to Do If Complications from Thrombolysis Occur

Complications from thrombolysis can sometimes arise after stroke treatment. Common issues include intracerebral hemorrhage (ICH) and systemic bleeding. For instance, if a patient develops ICH, they may experience sudden headache or confusion, necessitating immediate imaging to assess the situation. Let's say a patient, originally treated with alteplase, suffers a 5% chance of ICH, which translates to about 1 in 20 patients. It's crucial that the medical team closely monitors the patient's neurological status and vital signs. If complications occur, timely intervention is key. Treatment may involve supportive care or even surgical options, depending on the severity of the complication, ensuring the best possible outcomes.



Cryoprecipitate Administration for Thrombolysis-Related Bleeding

Cryoprecipitate is made by thawing fresh frozen plasma at 1–6 °C and collecting the cold-insoluble proteins: fibrinogen, factor VIII, factor XIII and von Willebrand factor.

Indication Bleeding after alteplase or tenecteplase — replaces the fibrinogen they consume.

Dose 10 units ($\approx$ 3–4 g fibrinogen), or about 0.15 units/kg, over 10–30 min.

Target Fibrinogen $\geq$ 150 mg/dL; recheck and repeat if lower.

Alternative Tranexamic acid 1 g IV over 10 min.

Storage Frozen at ≤ -18 °C for up to 12 months; use within 4 h of thawing.



Advancements in Stroke Management — 2026

Endovascular Thrombectomy (EVT)

Class 1 up to 24 h — now including large cores (ASPECTS 3–5) and basilar occlusion with NIHSS ≥ 10 . Medium and distal occlusions: no benefit in ESCAPE-MeVO and DISTAL (2025).

Thrombolytic Therapy

Tenecteplase joins alteplase as Class 1. Imaging-selected thrombolysis up to 9 h (Class 2a).

Telemedicine

Telestroke for remote decisions; mobile stroke units are now Class 1.

Rehabilitation

AHA/ASA 2026 rehabilitation guideline: gradual early mobilisation, no very intense exertion in the first 24 h, task-specific training.

AHA vs ESO: Thrombolysis

AHA/ASA 2026: Class + level of evidence · ESO: GRADE — strong/weak + quality of evidence

Question	AHA/ASA 2026	ESO	Verdict
Tenecteplase < 4.5 h	0.25 mg/kg or alteplase — Class 1, LOE A	Alternative to alteplase — strong, moderate quality (2023)	Agree
LVO going to thrombectomy	Either agent; never skip IVT (Class 1)	Tenecteplase preferred over alteplase — strong (2023)	ESO goes further
Tenecteplase 0.4 mg/kg	Class 3: No Benefit	Recommended against — strong (2023)	Agree
4.5–9 h, perfusion mismatch	May be reasonable — Class 2a, B-R	Recommended — strong, low quality (2021)	ESO stronger
Wake-up, DWI–FLAIR mismatch	Class 2a, B-R	Recommended — strong, high quality (2021)	ESO stronger
Mild non-disabling deficit	No IVT (Class 3); DAPT if NIHSS ≤ 5 , up to 72 h	No IVT (2021); DAPT if NIHSS ≤ 3 , within 24 h (2021)	Agree — AHA wider DAPT

ESO: Berge 2021 (IVT), Alamowitch 2023 (tenecteplase), Dawson 2021 (DAPT). AHA: Prabhakaran 2026.

AHA vs ESO: Thrombectomy & Blood Pressure

Where the American guideline has moved ahead, and where both agree

Question	AHA/ASA 2026	ESO	Verdict
Large core, ASPECTS 3–5	Class 1 at 0–24 h (6–24 h: age < 80, NIHSS ≥ 6, no mass effect)	ESO–ESMINT 2019 guideline predates the large-core trials	AHA ahead
Basilar artery occlusion	Class 1, LOE A: NIHSS ≥ 10, PC-ASPECTS ≥ 6, ≤ 24 h	Suggested — weak, very low quality; NIHSS ≥ 10 (2024)	Same direction, less certainty
BP before IVT	< 185/110 (Class 1)	< 185/110 (2025)	Agree
BP 24 h after IVT or EVT	< 180/105	< 180/105 (2025)	Agree
SBP < 140 after successful EVT	Class 3: Harm (first 72 h)	Recommended against — high certainty (2025)	Agree

ESO: ESO–ESMINT 2019 (thrombectomy), ESO–ESMINT 2024 (basilar), ESO 2025 BP update. AHA: Prabhakaran 2026.

Role of AI in Stroke Imaging and Netrin-1 Usage

AI Applications

AI technologies assist in detecting ischemic and hemorrhagic strokes, improving imaging analysis speed and accuracy.

Deep Learning

Convolutional neural networks enhance infarct detection, segmentation, and classification in acute stroke imaging.

Netrin-1

Experimental (preclinical) neuroprotective agent that promotes brain tissue repair and neural regeneration post-stroke by regulating angiogenesis, apoptosis, and neuroinflammation.

Decision Support

AI aids in triage, quantification, and prognostication, helping clinicians make informed decisions quickly.

VR in Rehabilitation and Future Directions

1. Virtual Reality (VR)

Utilized in rehabilitation to create engaging therapy sessions that improve motor function and cognitive skills through immersive environments.

2. Personalized Rehabilitation

VR programs can be tailored to individual needs, enhancing motivation and adherence to therapy.

3. Regulatory Frameworks

Need for clear guidelines to ensure safe AI and VR integration into clinical practice.

4. Bias and Generalizability

Addressing algorithmic bias and ensuring AI systems are applicable across diverse populations.

5. Research Priorities

Focus on prospective clinical trials to validate AI tools and VR in stroke management and ensure their effectiveness and reliability.

SEHA Virtual Hospital [Tele-Stroke] in KSA

Contact Information

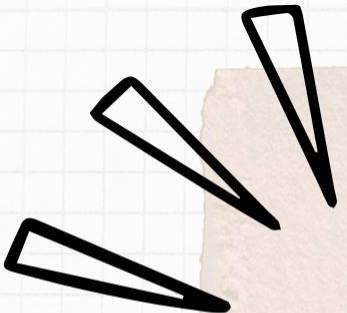
Phone number: +966 53 903 8345

Before Calling

- Ensure patient stability.
- Make sure CT and CTA are conducted.
- Calculate NIH score promptly.

Resources

Different guidelines and studies for reference, including AHA Journals, American Stroke Association, National Clinical Guidelines for Stroke, and others.



The Critical Role of Time in Stroke Treatment

Acting swiftly can save lives and reduce disabilities



Pre-Test: The Answers

Q1 · The dose

A

20 mg (4 mL) as a single IV bolus

0.25 mg/kg × 80 kg = 20 mg; at 5 mg/mL that is 4 mL. 40 mg is the cardiac dose; 72 mg is alteplase; 25 mg is only the maximum (≥ 100 kg).

AHA/ASA 2026: tenecteplase 0.25 mg/kg, max 25 mg — Class 1

Q2 · The clock

B

IV thrombolysis

4.5–9 h with salvageable penumbra (core < 70 mL, penumbra ≥ 10 mL, ratio ≥ 1.2) — the EXTEND criteria. No LVO, so no thrombectomy; MRI would only delay treatment.

AHA/ASA 2026: Class 2a · ESO 2021: recommended

Q3 · The mild stroke

C

Aspirin + clopidogrel (dual antiplatelets)

The deficit is not disabling, so thrombolysis adds risk without benefit (PRISMS, ARAMIS). Dual antiplatelets prevent early recurrence. Early full anticoagulation does not help.

AHA/ASA 2026: IVT Class 3 (No Benefit); DAPT recommended

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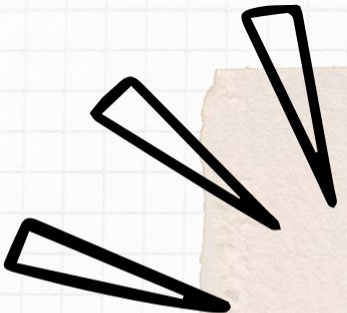


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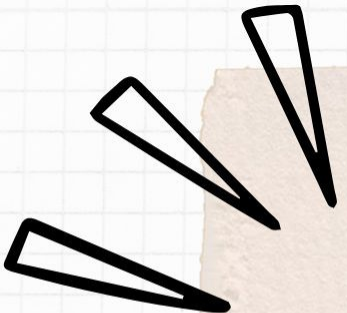
Updated to the AHA/ASA 2026 guideline, with the ESO comparison, tenecteplase and the extended window.

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Participation**

