

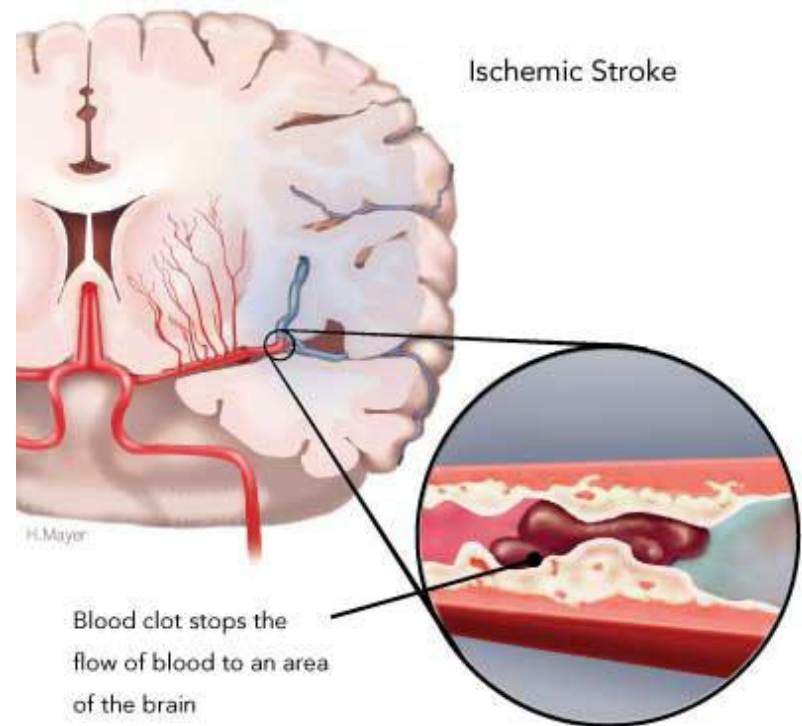
# ISCHEMIC STROKE

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# ISCHEMIC STROKE

- Is a neurologic disorder that develops acutely in a certain area of brain with impaired blood flow due to vascular injury.



# ISCHEMIC STROKE

- Is an important cause of morbidity & mortality
  - %30 permanent sequel
  - Important economic burden
  - 3.rd cause of all deaths

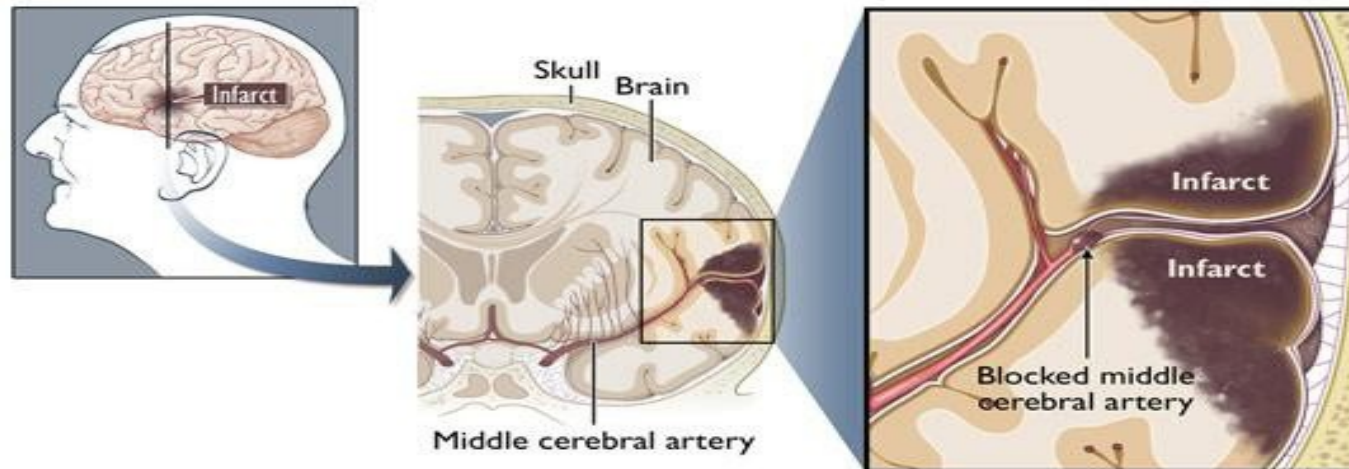
# Ischemic stroke

- Acute ischemic stroke is a real emergency
- Focal vascular occlusion
- Cut off in cerebral glucose and oxygen flow
- Degradation of metabolic reactions in the affected brain area
  - 80% of all strokes are due to vascular occlusion.
  - Symptom onset may be sudden or slowly, neurologic function loss may be temporary or permanent.

- In ischemic stroke, with decrease of cerebral blood flow;
- Intracellular acidosis → cell death
- The cellular survival after cerebral blood flow interrupted → 2 hours
- Electrical activity stops and ischemic penumbra develops

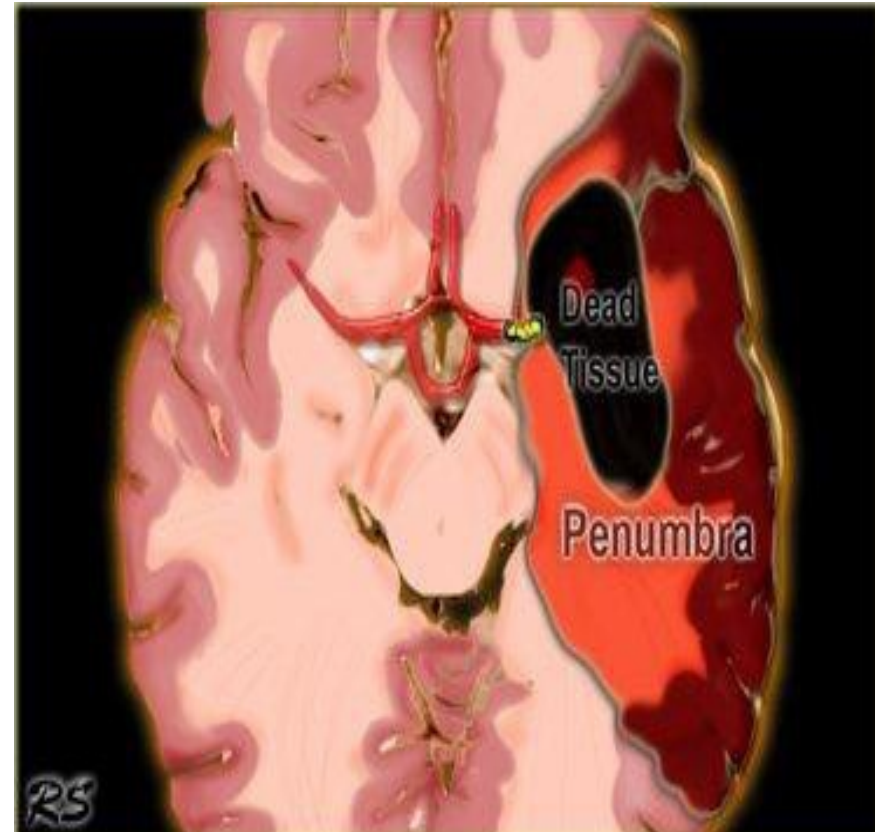
• After 6 hours irreversible damage

Large ischemic stroke in the brain



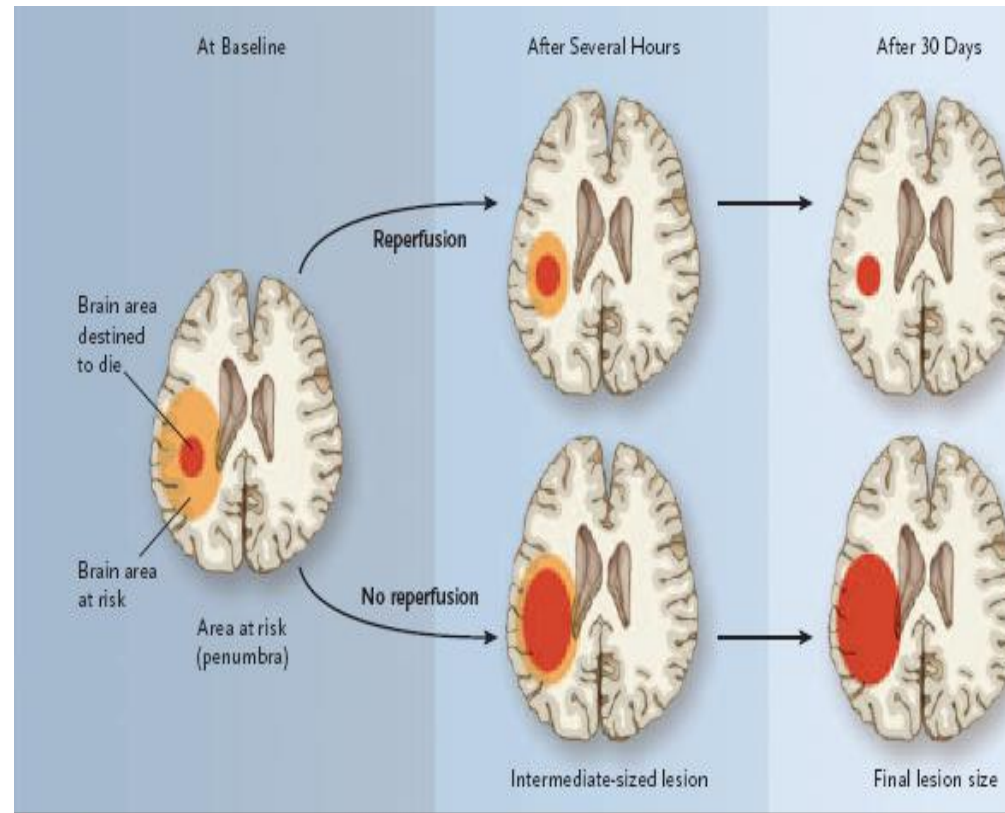
# Penumbra

- Irreversible damage develops in a short time
- Around the ischemic center area,
- Blood flow is decreased,
- But, the damage is not permanent yet.



## PENUMBRA

- The tissue to be saved
- Target area of therapy
- r-tPA; saves penumbra
- CT does not distinguish
- MRI does.



**Figure 2. Representation of Penumbra in Acute Stroke.**

The territory of the brain at risk for infarction is shown in yellow, and the brain destined to die is shown in red. The tissue shown in yellow represents potentially salvageable brain cells if reperfusion occurs rapidly.

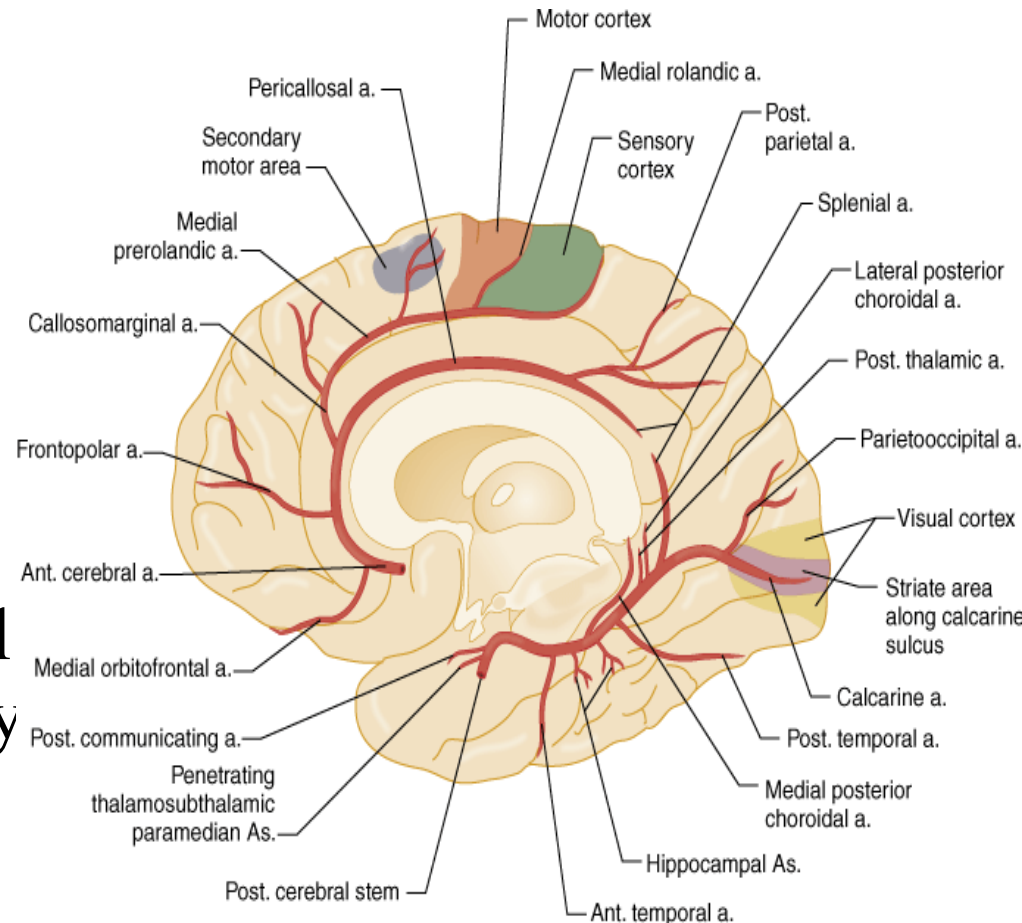
# Therapy

- Current interventional therapy regimens
  - Blood pressure management
  - Anticoagulants and thrombolytic therapy
  - Catheter-based interventions and surgery.
- 
- Early diagnosis and treatment before the neurologic damage become permanent is the key for success.



# Pathophysiology

- Clinical signs are correlated with the localisation of stroke
- Collateral blood flow determines the clinical symptoms and severity of stroke.



## 1-Thrombotic occlusion

- Branch points of main cerebral artery are affected
- The most common cause is atherosclerosis
- Atherosclerotic plaque development → ulcerated plaque and vascular trauma (HT) → platelet adhesion → clot formation → vascular occlusion
- The onset of symptoms are slow

## 2-Stroke due to hypoperfusion

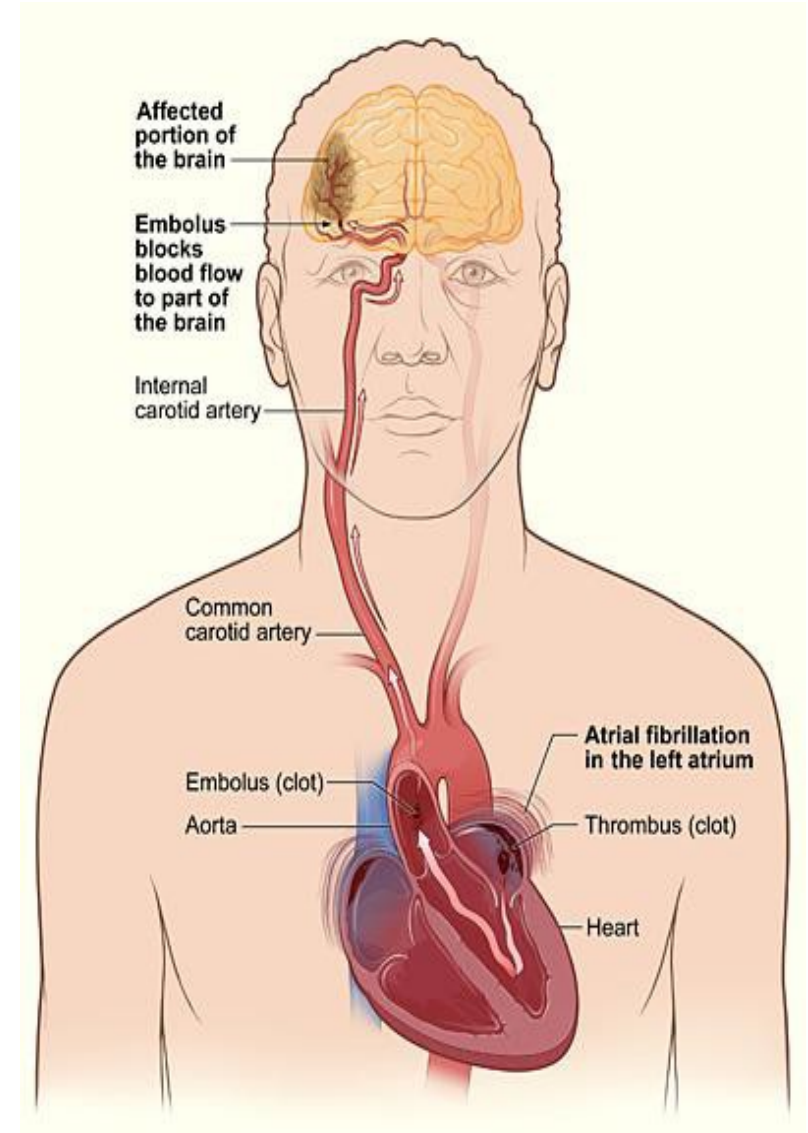
- Large infarct can be seen after systemic hypotension caused by heart failure

### 3-Cardioembolic occlusion

- Intravascular clot migrates from proximal to distal and causes occlusion
- Symptom onset is sudden

Emboli source:

- Mural thrombus and atrial fibrillation
- Dilated cardiomyopathy
- Mitral stenosis
- Endocarditis
- Prosthetic valve
- AMI



# Management

- Time is critically important.
- Stroke symptoms and signs must be quickly detected
- EMS must be quickly activated
- Quick transfer to hospital
- Quick emergency department triage

# Management

- Quick clinical assessment in emergency department,
- Airway secure
- Is the patient candidate for thrombolytic therapy?

# Ischemic stroke

- Time loss → Myocardium loss
- UAP → ----- → ----- → AMI
- Time loss → Brain tissue loss
- TIA → ----- → ----- → Ischemic Stroke

# Ischemic stroke/ Target times

- Patient must be examined in 10 minutes.
- CT must be taken in 25 minutes
- CT must be interpreted in 45 minutes
- t-PA in 60 minutes (if there is no hemorrhage)  
think, discuss, consult.

# Ischemic stroke / History

- Time of symptom onset? IMPORTANT!!!

\*IS THE PATIENT CANDIDATE FOR THROMBOLYTIC THERAPY ?

- When did you see the patient last time?
- Symptom onset is sudden? slow?
- Headache, nousea, vomiting (hemorrhagic stroke)
- Cervical trauma in near past (Carotid dissection)



# Risc factors

- Elderly, HT, Smoking
- Coronary arterial disease , DM, Valvular heart disease
- AF, hiperlipidemia
- Disorders that increase blood viscosity
- Oral contraception
- Cerebrovascular disease or TIA in the past

# Symptoms

- Sudden-onset numbness or loss of power in face, arm or leg-especially one-sided
- Decrease of consciousness or aphasia
- Sudden loss of memory, orientation or perception
- Decrease in visual acuity or diplopia
- Sudden vertigo or imbalance
- Sudden severe headache

# Atypical Symptoms

- Loss of consciousness or syncope
- Dyspnea
- Sudden pain in face, chest, arms and legs
- Falls and accidents
- Sudden hiccup, nousea, tiredness, palpitation
- Mental disorders

# Stroke mimics

- Systemic infections, cerebral tumors, toxic metabolic causes (especially hyponatremia), syncope,
- Seizure
- Hypoglycemia
- Hypertensive encephalopathy
- Complicated migraine
- Conversion

# Physical examination

- Most of stroke patients are stable
- Airway, breathing and circulation primarily.
- If fever is present; A complication like CNS infections (meningitis, encephalitis) or aspiration pneumonia etc. May be present
- Potential infection source must be investigated
- Meningismus signs?

# Neurologic examination

Tablo 5. GKS (Glaskow Koma Ölçeği)<sup>41</sup>.

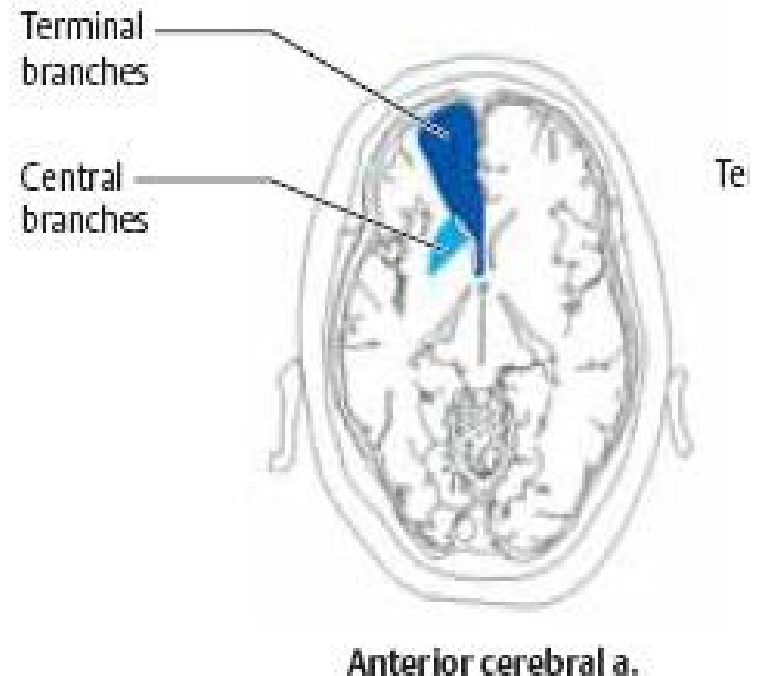
- Consciousness (GCS)
- Cooperation and orientation
- One-sided loss of power
- Dysarthria
- Ataxia
- Cranial nerve disorder (facial asymmetry)

<b>Göz açma</b>	
Kendiliğinden açar	4 puan
Sesli uyararla açar	3 puan
Ağrılı uyararla açar	2 puan
Yanıt yok	1 puan
<b>Motor yanıt</b>	
Emirlere uyar	6 puan
Ağrıyı lokalize eder	5 puan
Ağrıdan kaçır	4 puan
Ağrıya fleksör yanıt	3 puan
Ağrıya ekstensör yanıt	2 puan
Yanıt yok	1 puan
<b>Sözel yanıt</b>	
Anlamlı yanıt verir	5 puan
Ağrılı uyararla anlamlı yanıt	4 puan
Anlamsız yanıt	3 puan
Anlaşılmayan kelimeler çıkarma	2 puan
Yanıt yok	1 puan

# Ischemic stroke syndroms

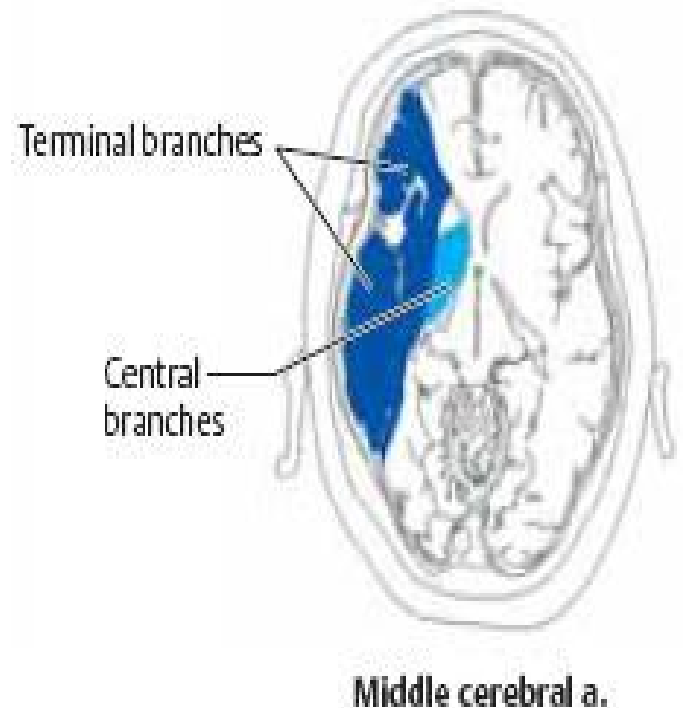
## Anterior Cerebral Artery Infarct

- Contralateral motor deficit, more at leg
- the flow of thought and speech impairment
- Incontinence of urine/gaita
- Gait disorder / incompetence



# Middle Cerebral Artery Infarct

- Contralateral motor and sensorial loss, more on face and arm than leg
- Dominant hemisphere  
→aphasia
- Agnosia
- Homonim hemianopsy ,  
ipsilateral anopsy





# Posterior Cerebral Artery Infarct

- Cortical blindness, visual agnosia, memory disorders
- Sensorial loss (light touch, two-point discrimination disorders)
- Patient can be unaware of the deficit
- May be with hypotension

# Vertebrobasilar Syndrome

- Posterior circulation → brain stem, cerebellum, visual cortex
- Vertigo, diplopia, dysphagia, ataxia, cranial nerve deficits
- Bilateral extremity weakness, syncope
- Cross neurological deficits

## → **Basillary Artery Occlusion**

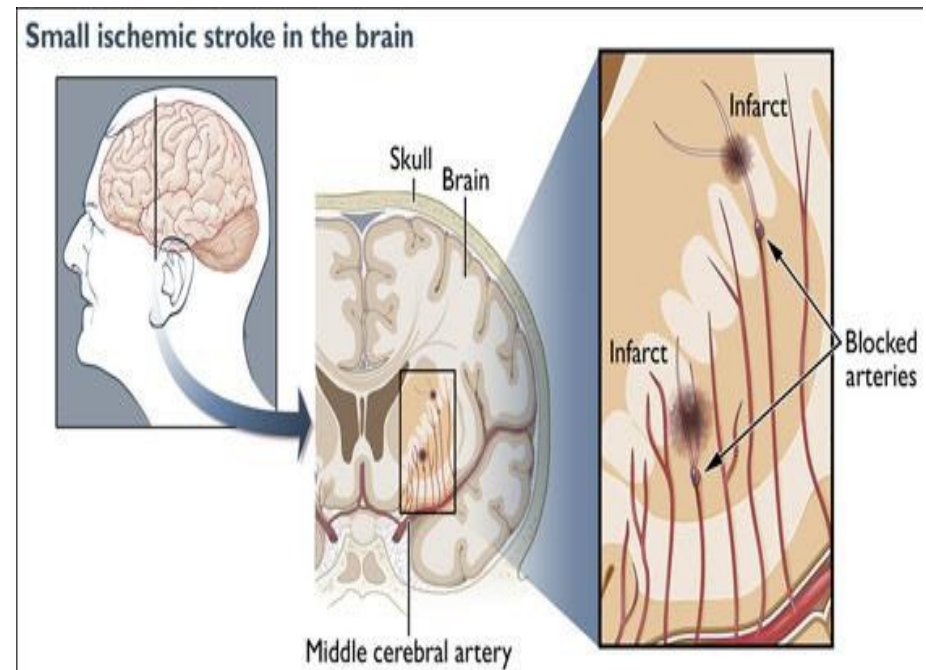
- Locked-in syndrom
- Quadriplegia, coma, looking up

## → **Cerebellar Infarct**

- “Drop attack”, vertigo, nousea, vomiting
- May be with cranial nerve deficits
- May be loss of consciousness in 6-12 hours

# Lacunary Infarct

- Little infarcts located at pons and basal ganglia, with hypertension
- Isolated motor deficits, Isolated sensory deficits, ataxic hemiparesia
- Subcortical located → Cognitive disorder, aphasia, no memory loss.
- 13-20% of all cerebral infarcts



# Transient Ischemic Attack (TIA)

- Neurological functional disorder lasting less than 1 hour, caused by cerebral or retinal ischemia without infarct signs.

# Transient Ischemic Attack

- Shows that there is severe risk for stroke.
- Mostly less than 5 minutes of duration.
- 3 or more TIA in 72 hours → crescendo TIA

## **after TIA**

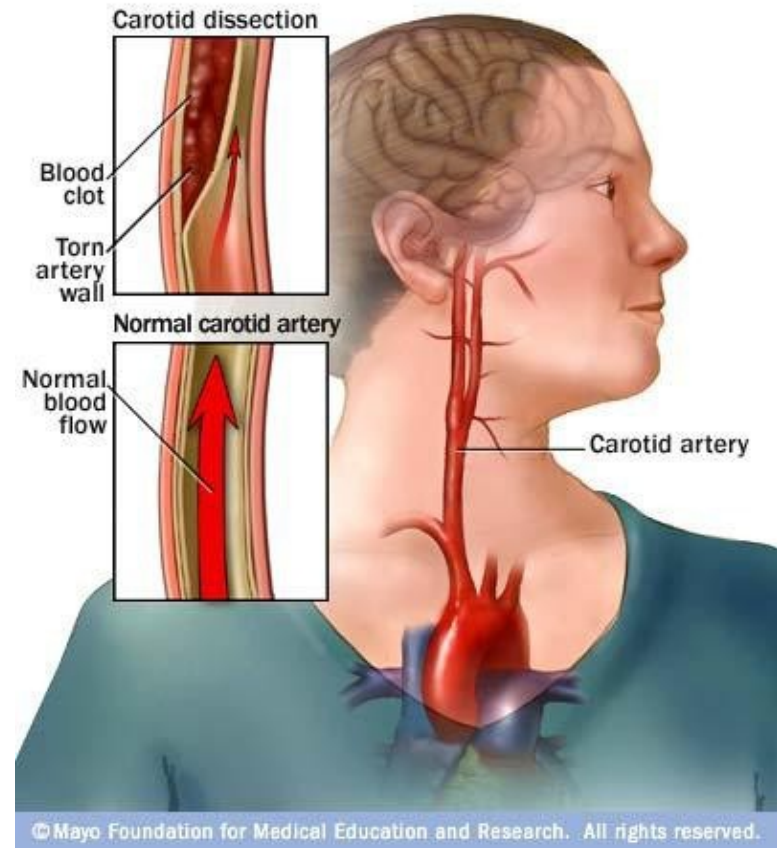
- Risk of cerebrovascular disease in 3 months → 10%
- 50 % of this 10% is in two days
- Risk of cerebrovascular disease in 5 years → 50%

# Young population

- 4% of strokes are in 15-45 age group
- Pregnancy, oral contraception
- Protein S and C deficiency
- Polycitemia
- Lupus anticoagulants and anticardiolipin anticors
- Antiphospholipid anticors increases tendency to thrombosis.
- Fibromuscular dysplasia
- Migren syndroms
- Cocaine and amphetamine

# Carotid and Vertebral Dissection

- Often associated with trauma.
- An important cause of stroke in young population
- Intimal damage occurs.
- The narrowing causes occlusion or embolism.





# Carotid and Vertebral Dissection

## Signs

- Horner syndrome,
- Headache and facial pain at affected side,
- Visual changes,
- Cranial nerve deficits,
- Angiography is standard for diagnose.
- Therapy : Early anticoagulation or endovascular intervention

# Therapy for ischemic stroke in emergency

- ABC (is there life-threatening airway problem ?)
- Establish IV line
- Oxygene (Oxygene saturation must be more than 92% with pulseoxymeter)
- No oral intake (Aspiration risc)
- Head of the bed must be lifted 30 degrees,
- Cardiac monitarisation
- the presence of AF must be questioned
- the presence of AMI must be questioned
- Troponin levels can be high in stroke commonly
- ECG changes are common and determinant for 3-month mortality

# Diagnostic tests in ischemic stroke

- **Laboratory tests**
- Whole blood count (trombocytopenia)
- Coagulation tests: Important for thrombolytic candidates
- Electrolytes (Na an Ca abnormalities can cause stroke-like symptoms)
- Renal function tests
- Blood glucose level
- ECG
- Toxicologic tests for selected patients

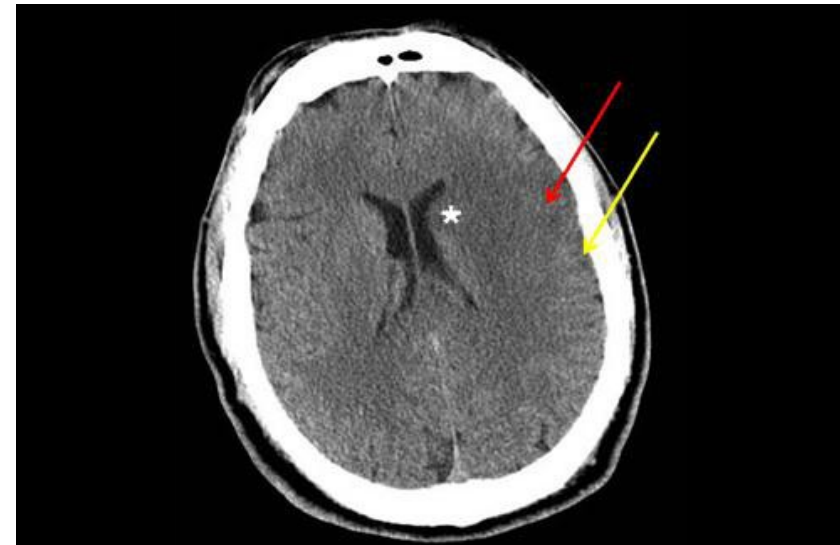
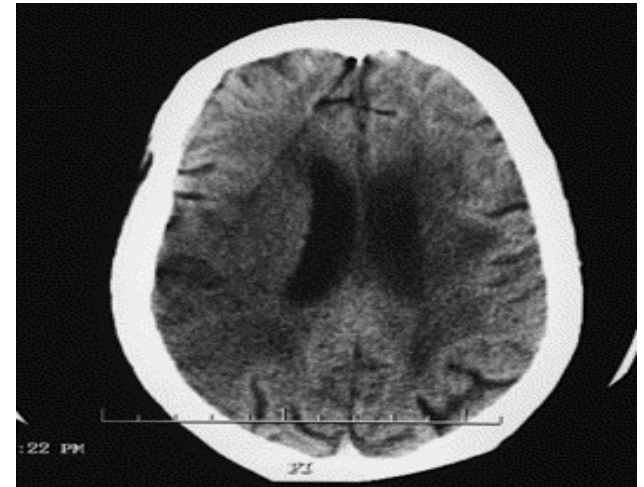
# Imaging

## **Non-contrast CT**

- Makes distinction between ischemic or hemorrhagic stroke
- Differential diagnose (stroke mimics, tumor, abcess,etc.)
- Ischemic stroke does not show a sign in first 6 hours usually
- Expert review is important if thrombolytic therapy planned.
- There are signs in first 6 hours → bad prognosis
- Hypodensity that is a sign of infarct appears after 24-48 hours

# Ischemic stroke (diagnosis)

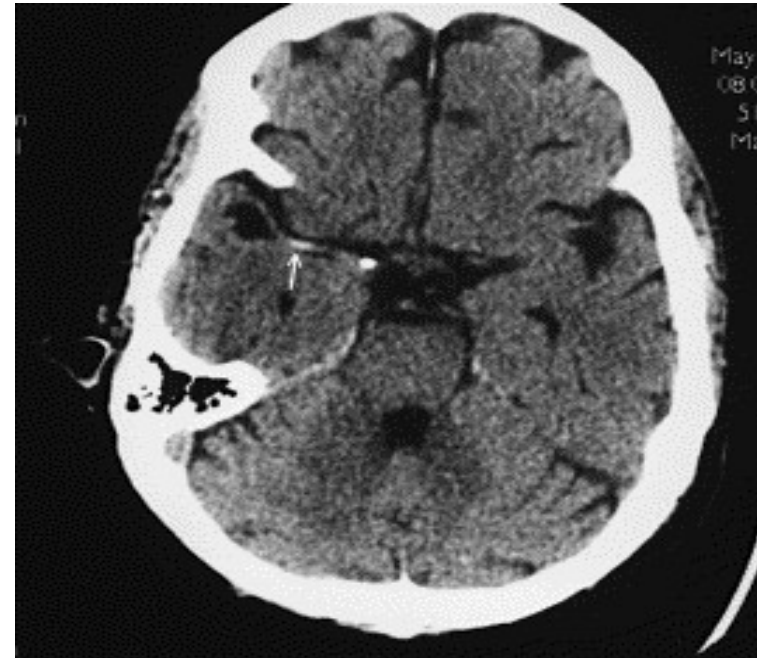
- CT early signs;
- blurring of the boundaries of gray-white matter
- edema
- Sulcus effacement



- Hyperdens MCA sign

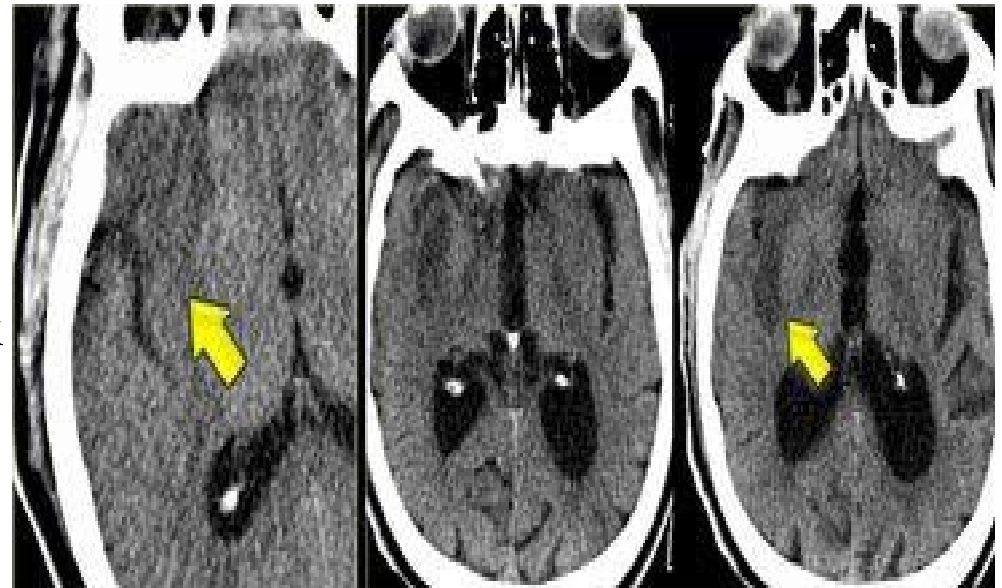
Early sign of MCA stenosis

Shows poor prognosis

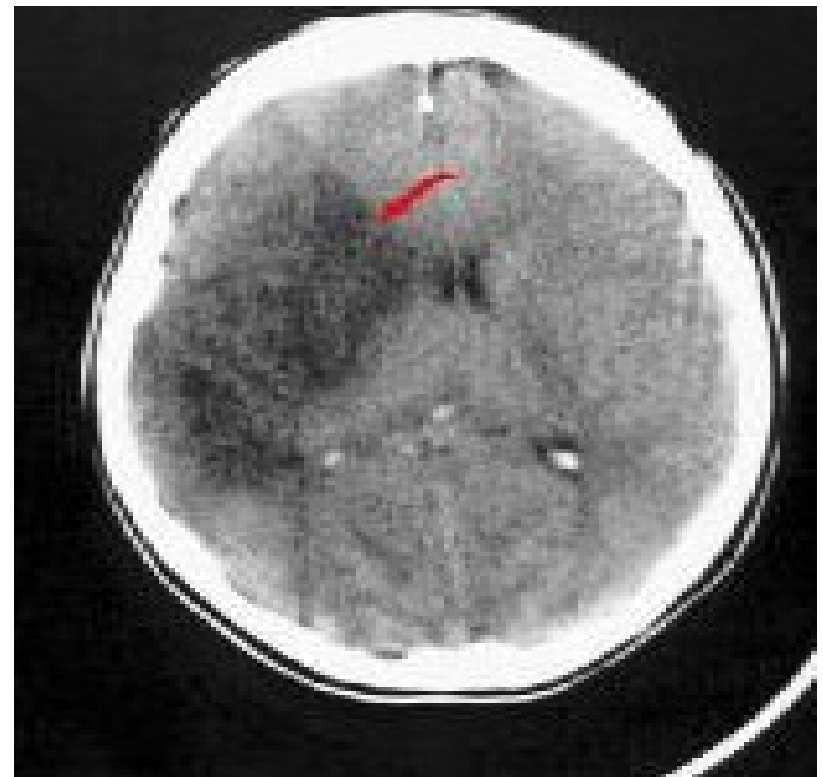


- Insular ribbon sign

Hypodensity at insular cortex  
MCA stenosis

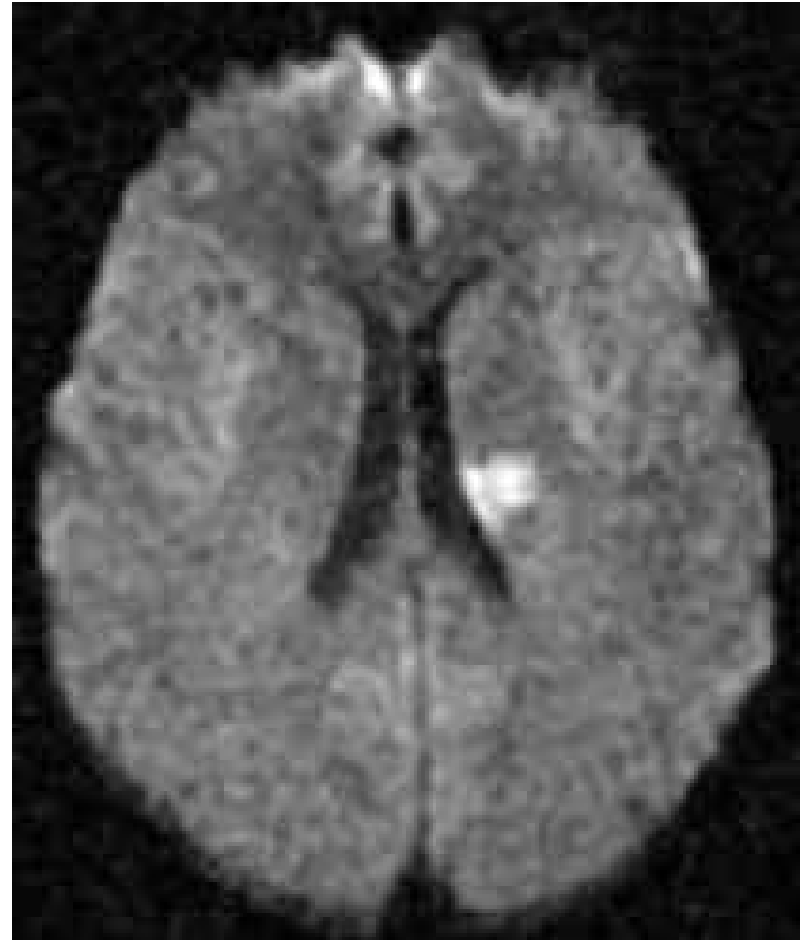


# Hypodensity compatible with ischemia



## MRG

- More sensitive than CT in the early period
- More sensitive in posterior stroke
- Not preferred for hemorrhagic stroke
- Diffusion-perfusion is the most sensitive test;
- Penumbra can be distinguished with MRI





# Therapy for ischemic stroke in emergency

- Be aware for dehydration
- Increase in blood viscosity
- Hypotension
- Increases the risk for venous thromboembolism and causes bad results

- **Hypoxia must be prevented**

- 2-4 Lt O<sub>2</sub>

- Entubation and mechanic ventilation?

- If GCS <8

- Brain stem infarct? Severe MCA infarct?

- The benefit of hyperbaric oxygene therapy could not be demonstrated.

- **Hypotension must be prevented**
- Blood pressure is important for the blood flow to critical penumbra area.
- Target blood flow reduction: 10-25% per day
- For patients not candidate for thrombolytic therapy:

# **Hyperglycemia must be prevented**

- Poor prognosis
- Can effect blood-brain barrier
- Can cause brain edema
- Can increase the risk of hemorrhagic conversion of infarction?

# THROMBOLYSIS

- Can be done in first **4.5 hours from the symptom-onset**
- rtPA (Actilyse , *50 mg*)
- 0,9 mg/kg total dose → maximum 90 mg
- 10% bolus → rest infuse in 1 hour
- Neurologic examination in every 15 minutes for two hours
- No heparin or aspirin in first 24 hours.

# Contraindications for thrombolysis

**In first 3 hours period** (exclusion criteria)

- Head trauma or stroke in past 3 months
- Signs that makes suspicion for subarachnoid hemorrhage
- Arterial puncture in an uncompressible area for last 7 days
- Intracranial hemorrhage in history
- Blood pressure systolic >180, diastolic >110 mmHg
- Active hemorrhage signs in examination
- Acute bleeding diathesis;
  - Thrombocyte <100.000
  - Heparin intake in last 48 hours (aPTT >normal)
  - Anticoagulant use and INR >1.7 or PT > 15 seconds
- Blood glucose <50 mg/dl
- Multilobular infarct in CT (hypodense area >1/3 cerebral hemisphere)

# Thrombolysis contraindications

## **For admissions on 3-4.5 hours period**

Adding the previous contraindications

- Age > 80
- Very severe neurologic signs (NIHSS > 25)
- Oral anticoagulant use
- Previous stroke and diabetes

# Antiplatelet drugs

## **Aspirin**

- Cornerstone for preventing second stroke for patients that couldn't be given tPA
- 325 mg tb
- Must be given in first 48 hours (Class 1)
- Is not contrindication for tPA
- Cheap
- 20-25% preventing compared to plasebo



## →Dipiridamol

- 200 mg/day PO
- 15% decrease in stroke risk
- 37% decrease in risk when combined with aspirin

## →Clopidogrel

- Less side effects
- Not more efficient from aspirin
- Can be chosen for patients can not use aspirin
- Expensive

- **Heparin, LMWH**
- Not useful for patients without AF!
- In high risk for recurrent TIA
- High-degree stenosis compatible with symptoms
- Cardioembolic source, crescendo TIA
- TIA with antiplatelet therapy

# Warfarin

- For prevention of stroke patients with AF and TIA
- INR controls required: should be  $2,5 < \text{INR} < 3,5$

# Other therapies

- Intraarteria r-tPA
- Ultrasonographic thrombolysis
- Mechanical clot removal
- Defibrinating enzymes (ANCROD)
- Magnesium, Hypothermia
- Volume expanders, vasodilators
- Dextran, albumine, Metilxanthine derivatives
- Neuroprotectives
- Citicoline, Lubeluzole, Nimodipine

# Results

- Acute ischemic stroke is a real emergency,
- Fast and accurate evaluation in emergency dept. is important,
- First evaluate ABC, give O2 if necessary,
- Evaluate blood glucose, correct if necessary,
- Is candidate for thrombolytic?,
- CT in 25 min,
- Activate stroke team.

Hedef Kapı-iğne zamanı  $\leq 60$  dk



İLK 10  
DAKİKA

- Genel değerlendirme ve stabilizasyon
- ABC değerlendir, vital bulgular, gerekli ise O<sub>2</sub>
- DY, Laboratuvar tetkikleri ise EKG
- Kan şekeri bak, hipoglisemi varsa tedavi et
- Nörolojik değerlendirme, hikaye
- BT iste, Stroke ekibini aktive et



25 DAKİKA



45 DAKİKA



AS'e varış  
60 DAKİKA

İlk 4,5  
saat

BT istemi

BT ve laboratuvar sonuçlarını  
değerlendir

BT'de  
hemoraji

YOK

VAR

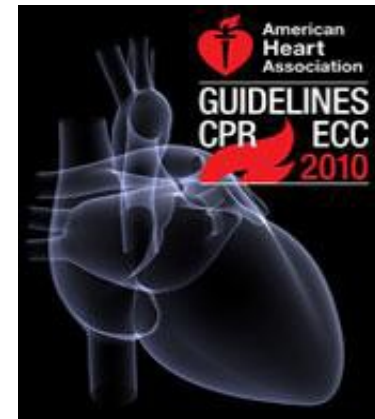
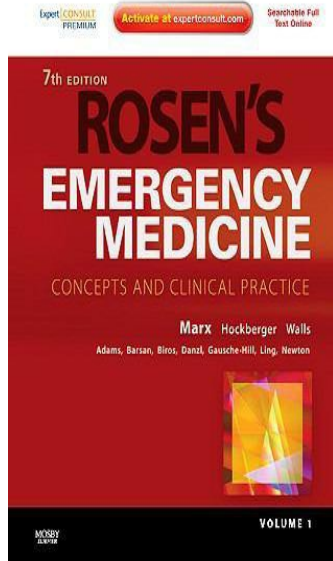
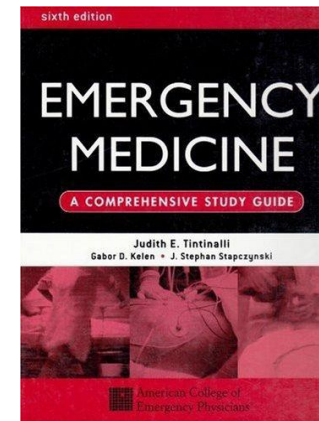
Fibrinolitik için  
Değerlendir

Kontrendike ise  
Aspirin ver

Benign stroke  
Yada hemoraji

Kontrendike değil  
UYGULA

Servis /Yoğun  
bakım



- Thanks..