Ischemic stroke

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The lecture is enough for the exam!

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Objectives:

- **Not given yet**

References:
Step up - Black
Doctor's notes - Red
davidson - Blue
Extra explanation - Grey

Optional:

p1237 to p1247

Editing file

The doctor focused only on management and prevention

❖ Epidemiology:

- A leading cause of serious, long-term disability
- A second to only heart disease in causing death world-wide
- For survivors aged > 65 years: 50% have hemiparesis, 30% are unable to ambulate, 19% are aphasic, 35% are depressed, 26% resides in nursing home
- The economic, social, and psychological costs of stroke are enormous.
- 25-40% recurrent stroke within 5 years
- 3-10% recurrent stroke within 30 days

Venous stroke

Only 1% of strokes are venous. Thrombosis within intracranial venous sinuses, such as the **superior sagittal sinus**, or in cortical veins may occur in pregnancy, hypercoagulable states and thrombotic disorders or with dehydration or malignancy. Cortical infarction, seizures and raised intracranial pressure result.

❖ Types of stroke:

- Ischemic stroke 85%
- Hemorrhagic stroke 15%

❖ Classes of stroke:

1- transient ischemic attack (TIA)	2-reversible ischemic neurologic deficit	3- evolving stroke	4- completed stroke
Neurologic deficit that lasts from a few minutes to no more than 24 hours, once a patient has a TIA, there is high risk of stroke in subsequent months	It lasts longer than 24 hours, but resolves in less than 2 weeks	Is a stroke that Is worsening	Which the maximal deficit has occurred

❖ Causes:

1. Emboli are the most common etiology. Origins from
   - Heart (most common)
     - As In patient with AFib
   - Internal carotid artery
   - Aorta
   - paradoxical
     - Emboli arise from blood clots in the peripheral veins then go to the arterial circulation through septal defect (eg: patent foramen ovale)

Thrombotic stroke – atherosclerotic plaques

2. Lacunar stroke – small vessel thrombotic disease (<1.5 cm3)
   - Only seen in MRI or at autopsy
3. Nonvascular causes: low cardiac output and anoxia (may cause global ischemia and infarction)

❖ Clinical features:

Deficits seen in stroke	
Distribution	**Location and/or type of deficiency**
Anterior cerebral artery	Contralateral lower extremity and face
Middle cerebral artery	Aphasia, contralateral hemiparesis
Vertebral/basilar	**Ipsilateral**: ataxia, diplopia, dysphagia, dysarthria, and vertigo **Contralateral**: homonymous hemianopsia with basilar—PCA lesions
Lacunar **Internal capsule** **Pons** **thalamus**	 Pure motor hemiparesis Dysarthria, clumsy hand Pure sensory deficits

❖ Diagnosis:

1- CT scan (without contrast) of head – initial test
- **Differentiates an ischemic from a hemorrhagic infarction**

2- MRI of brain – more sensitive than CT scan
- **However, in emergent cases and in unstable patient go first with CT**

3- ECG
- **Acute MI or atrial fibrillation may be the cause of embolic strokes**

4- carotid duplex ultrasound
- **Estimates the degree of carotid stenosis**

5- magnetic resonance arteriogram (MRA) is the definitive test
- **to confirm surgically accessible arterial stenoses,**

Clinically impossible to tell with certainty whether the stroke is ischaemic or haemorrhagic
That's why we need to be confirmed with CT or MRI
- **Ischemic** → t-PA unless contraindication
- **Hemorrhagic** → Supportive

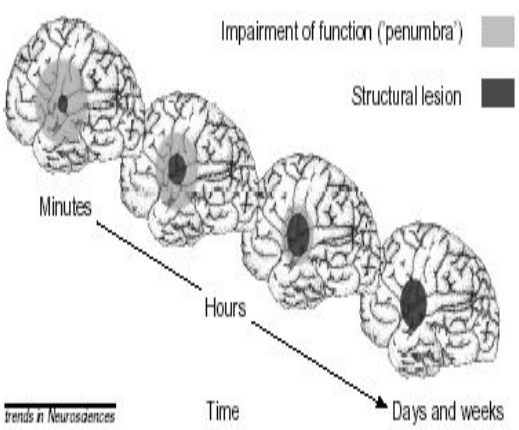
❖ Treatment

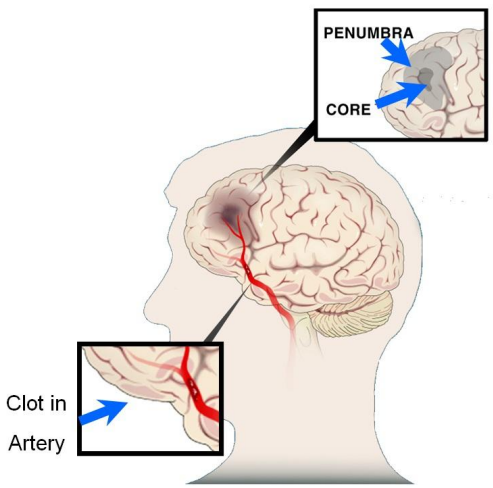
- **Prior to two decades ago, no treatment was offered for acute stroke victims because of the misconception that arterial occlusion in the brain leads to irreversible necrosis and dead tissue within minutes**
- **Stroke was wrongly named Cerebrovascular Accident (CVA)**
- **Stroke care was focused on supportive care, stroke prevention and rehabilitation**

"TIME IS BRAIN: SAVE THE PENUMBRA"

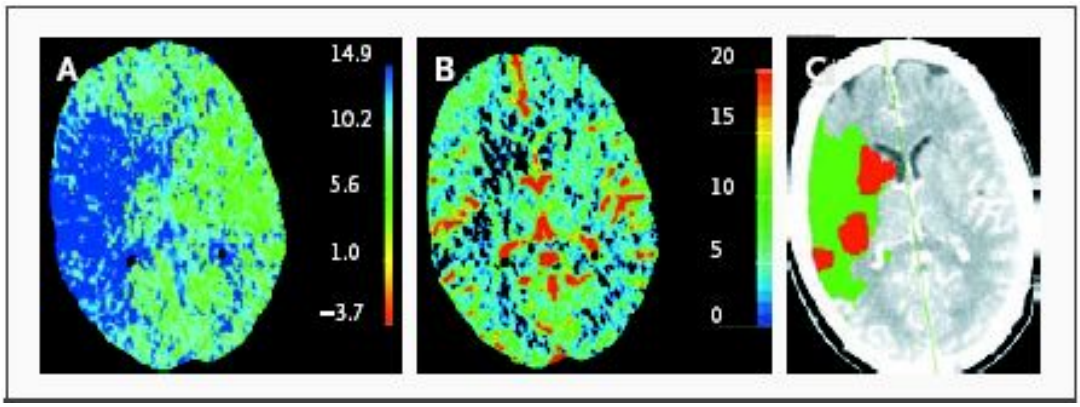
In every ischemic stroke, there is ischemic core and penumbra

Penumbra is zone of reversible ischemia around core of irreversible infarction salvageable in first few hours after ischemic stroke onset due to the collateral arteries that supply the penumbral zone.





Perfusion CT Scans Obtained 1 Hour 45 Minutes after the Onset of Ischemia in the Territory of the Right Middle Cerebral Artery



A large area shows prolongation of the mean transit time (in seconds) (Panel A), and a smaller area shows a reduction in cerebral blood volume (in ml per 100 g) (Panel B). These two maps suggest a large penumbra and a small infarct core (Panel C, with the penumbra shown in green and the suggested infarct core in red).

❖ Pharmacological recanalization:

- **Thrombolytic agent (Tissue Plasminogen Activator: t-PA)**

❖ NINDS trial:

- **Acute stroke patients were treated with either placebo or IV t-PA within 3 hours from the stroke onset**
- **Primary outcome: complete or nearly complete neurological recovery at 3 months after stroke**

The problem here patients present after 3 hours (in best centers only 3% will receive t-PA)

So, they tried it within 6 hours but it failed because of bleeding. Then the last study they tried within 4.5 hours and it worked

So, whenever a patient coming with acute stroke symptoms and the onset of symptoms is within 4.5 hours give t-PA unless there is contraindication

But after all that 6-7% will receive t-PA

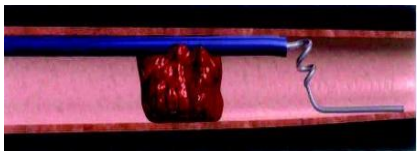
- **Don't give t-PA if the time of stroke is unknown or if the patient has any of the following: uncontrolled HTN, bleeding disorders, is taking anticoagulants or has a history of recent trauma or surgery**
- **If t-PA is given, there is a risk of intracranial hemorrhage. Therefore, don't give aspirin for the first 24 hours**
- **Anticoagulants (heparin or warfarin) have not been proven to have efficacy in acute stroke**

❖ Challenges to the utilization of t-PA include:

- **Narrow eligibility and treatment window**
- **Risk of hemorrhage**
- **Perceived lack of efficacy in large vessel occlusion**
- **Limited pool of stroke expertise in the community**
- **Through a standard acute stroke treatment protocol the time from ER door to IV t-PA must be reduced to as short as 2o minutes**

❖ Mechanical Recanalization

1-Mechanical Embolus Removal in Cerebral Ischemia (MERCI) Trial: An open label non-randomized study that evaluated the safety and efficacy of clot removal by the MERCI retriever within 8 hours.



After the microcatheter transverses the thrombus, the first loops of the Merci Retriever are delivered distal to the occlusion site

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The Merci Retriever is pulled back at the contact of the thrombus, additional loops are delivered within the thrombus, and the Merci Retriever is torqued to ensnare the thrombus

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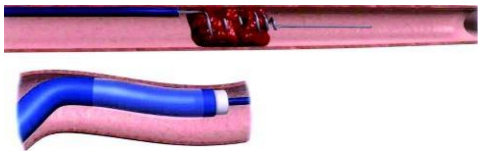

The balloon of the balloon guide catheter (BGC) (insert) is inflated to control antegrade flow, and the Merci Retriever is pulled back with the ensnared thrombus toward the tip of the BGC where it is aspirated

LICA angiogram showing MCA occlusion (arrow)

Complete recanalization

Embolectomy performed using a MERCI retriever device can result in successful recanalization.

the FDA in 2005 approved the MERCI retriever for removing clot within 8 hours of stroke symptoms.

Recanalization: 48%. Complications: 7% (emboli, dissection, subarachnoid hemorrhage). Good outcome: 28% (46% recanalized, 10% occluded). Mortality: 43% (32 recanalized, 54% occluded). Symptomatic hemorrhage occurred in 5%.

2-Penumbra micro-catheters

Advantages	Disadvantages
Can be used in some patients with contraindications to thrombolysis 8-hour window **Initial data indicates higher revascularization rates relative to other methods.** **Preliminary data shows better outcome at 90 days relative to other devices show**	**Vessel tortuosity precludes use** **Distal vessels not reachable** **Operator experience** **Higher rate of symptomatic intracerebral hemorrhage**

3- Phenox Clot Retriever: it has a system with a highly flexible core wire compound resembling a pipe cleaner

4- Stent Placement in Acute Stroke

Summary for stroke treatment

1- IV t-PA was effective and is FDA approved for acute stroke treatment within 4.5 hours of stroke onset

2- Mechanical thrombolysis with angioplasty was effective, within six hours from the symptoms onset, in improving outcome in four large randomized clinical trials

3- MERCI retriever proven effective within Eight hours from Stroke Symptoms and FDA Approved.

4- Penumbra proven effective within eight hours from stroke symptoms and FDA approved

❖ Prevention

Estimated that up to 80% of strokes could be prevented

Nonmodifiable risk factors	
Age	**The risk of stroke doubles in each successive decade after 55 years of age**
Race	**Men have higher age-specific stroke incidence rates than women, except in 35-44 year olds and in those over 85 years of age. Stroke related case-fatality rates are higher in women than men**
Sex	**Blacks and some Hispanic Americans, have high stroke incidence and mortality rates compared with whites (Blacks have 38% greater incidence of stroke than whites.**
Family history	**Both paternal and maternal history of stroke may be associated with increased stroke risk (RR paternal history: 2.4 and RR maternal history: 1.4.**
Birth weight	**Birth weight is inversely associated with incident of stroke.**

Well-Documented Modifiable Risk Factors	
Hypertension	**-It is a major risk factor for stroke. -Both systolic and diastolic hypertension are important risk factors for stroke -Isolated systolic hypertension is an important risk factor for stroke in the elderly -There is compelling evidence for more than 30 years that the control of high blood pressure contributes to the prevention of stroke. -Unfortunately, a significant proportion of the population has undiagnosed or inadequately treated hypertension, especially in high-risk race/ethnic groups. -Regular screening for hypertension (at least every 2 years in adults). Management should include both lifestyle modification and antihypertensive medications.**
Smoking	**-25% of adults are active smokers -A prospective estimate of a 1.8-fold increase in stroke risk associated with -smoking from the Framingham Heart Study. -Former smoking also place individuals at increased risk for stroke (RR 1.34). -Exposure to environmental tobacco also increase the risk of stroke. -Patient and family should be encouraged to stop smoking (counseling, nicotine replacement etc..)**
Diabetes	**-It is an independent risk for stroke (RR 1.8 to 6). -High BP is common in patients with type 2 diabetes, with a prevalence of 40 to 0% in adults. -Tight BP control resulted in a convincing 44% relative risk reduction. -Glycemic control is recommended to reduce microvascular complications.**
Hyperlipidemia	**-There is an association between serum cholesterol and an increasing risk of stroke (1.8 to 2.6) -An inverse relationship between HDL and stroke was demonstrated -SPARCL Trial: 80 mg of Atorvastatin per day reduced the overall incidence of strokes and cardiovascular events, despite a small increase in the incidence of hemorrhagic stroke**

Other Well-Documented Modifiable Risk Factors: Sickle Cell Disease, Asymptomatic Carotid Stenosis, Atrial Fibrillation

Potentially Modifiable Risk Factors	
Obesity	**-BMI >30 kg/m2 predisposes to cardiovascular disease in general and stroke in particular -Recent evidence support abdominal obesity in men and obesity in women as independent risk factors for stroke -Weight reduction in overweight persons is recommended on the basis of the associated increase in comorbid conditions. Reduction in stroke risk with weight loss has not been established**
Physical inactivity	**-Framingham Study and the Nurses' Health Study demonstrated an inverse association between level of physical activity and stroke incidence -NHANES and the Northern Manhattan Study showed protective effects of leisure-time physical activity in Blacks and Hispanics -Americans should exercise moderately for at least 30 minutes on most, and preferably all days of the week. For stroke, the benefits are apparent even for light to moderate activities such as walking**
Poor diet/nutrition	**-There is no evidence that the use of dietary vitamin E or C supplements reduces the risk of stroke -Based on the nurses' Health Study, there may be a protective relationship between stroke and consumption of fruits and vegetables, especially green leafy vegetables and citrus fruit and juice -A healthy diet containing at least 5 daily servings of fruits and vegetables may decrease the risk of stroke**
Hormone replacement therapy	**-Framingham Heart Study: 2.6-fold increase in the relative risk of stroke among women receiving hormone replacement therapy compared with non-users -Women Health Initiative Study: Increased risk of stroke, CHD, and pulmonary embolism in the arm receiving HRT**
Oral contraceptive use	**-A meta-analysis concluded that the risk of ischemic stroke is increased in oral contraceptive users but that the absolute increase in risk is small -Women who are cigarette smokers, are hypertensive, or have diabetes, migraine, or prior thromboembolic events may be at increased stroke risk if they use oral contraceptives -Oral contraceptives should be avoided in women with additional risk factors (cigarette smoking, or prior thromboembolic events)**

Other Potentially Modifiable Risk Factors: Alcohol Abuse, Hyperhomocysteinemia, Drug Abuse, Hypercoagulability, Inflammatory Processes

MCQ's

Q1: A 62-year-old, right-handed man has a sudden onset of neurologic deficits. While he was watching the news on television, he suddenly could not move his right upper extremity or speak. His family promptly transported him to the nearest emergency room, where he arrived about 20 minutes after the onset of symptoms. He is found to be normotensive, awake, and alert but unable to move his right arm or articulate his speech. He can understand what is said to him but can only respond by nodding his head or motioning his left arm. He denies the presence of any headache when his symptoms developed. He is rapidly moved to the CT scan machine, and a CT scan of his head is completed within the next 20 minutes. The scan shows a small area of cortical ischemia on the left side, affecting the motor strip and the speech center. There are no radiologic signs of intracranial bleeding. By the time he returns from the scanner, approximately 50 minutes have elapsed since his symptoms began. His neurologic deficits have not changed. Which of the following should be the next step in management?
(A) Continued clinical observation for 3 hours
(B) Duplex scanning of his carotid arteries
(C) Emergency left carotid endarterectomy
(D) Intravenous heparin and loading dose of oral coumadin
(E) Intravenous infusion of tissue-type plasminogen activator

Q2: A 79-year-old man is admitted with left hemiparesis. CT reveals a middle cerebral artery infarct. What is his most significant risk factor for stroke?
A. Hypertension
B. Smoking
C. Family history
D. Diabetes
E. Cholesterol

Q3: A 77-year-old woman is admitted to hospital with a urinary tract infection. She receives antibiotics and seems to be responding well. On the fourth day she iseating her lunch when she suddenly drops her fork. She calls for the nurse who notices the left side of her face is drooping. What is the best next course of action?
A. CT head
B. Thrombolysis
C. MRI head
D. Aspirin
E. Place nil by mouth

Q4: A 71-year-old right-handed male is brought in by ambulance at 17:50 having suffered a collapse. His wife came home to find him on the floor unable to move his right arm or leg and unable to speak. Her call to the ambulance was logged at 17:30. He has a past medical history of well-controlled hypertension, ischaemic heart disease and atrial fibrillation for which he is on warfarin. He had a hernia repair three months ago and his brother had a 'bleed in the brain' at the age of 67.
What is the absolute contraindication to thrombolysis in this male?
A. Family history of haemorrhagic stroke
B. History of recent surgery
C. Time of onset
D. Current hemorrhagic stroke
E. Warfarin treatment

Answers: 1.E, 2.A, 3.E, 4.C

Thank you

If you have any question please contact with us at:
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