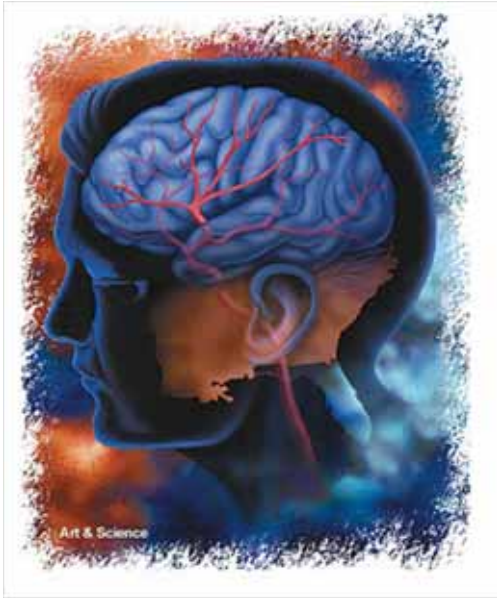




COMMITTED TO HEALING,  
DEVOTED TO CARING



# ISCHEMIC STROKE

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Apollo Bramwell Hospital



## Causes of Death

Top ten causes of death, all ages  
Mauritius, 2002

Causes	Deaths		Years of Life Lost
	(000)	(%)	(%)
All causes	7	100	100
Ischaemic heart disease	2	26	20
Cerebrovascular disease	1	16	11
Diabetes mellitus	0	5	4
Nephritis and nephrosis	0	4	3
Lower respiratory infections	0	3	3
Hypertensive heart disease	0	3	2
Cirrhosis of the liver	0	2	3
Asthma	0	2	2
Road traffic accidents	0	2	4
Perinatal conditions	0	2	6

Source: [Death and DALY estimates by cause, 2002](#)

<http://www.who.int/entity/healthinfo/statistics/bodgbddeathdalyestimates.xls>



# 2000 HOUSING AND POPULATION CENSUS REPUBLIC OF MAURITIUS

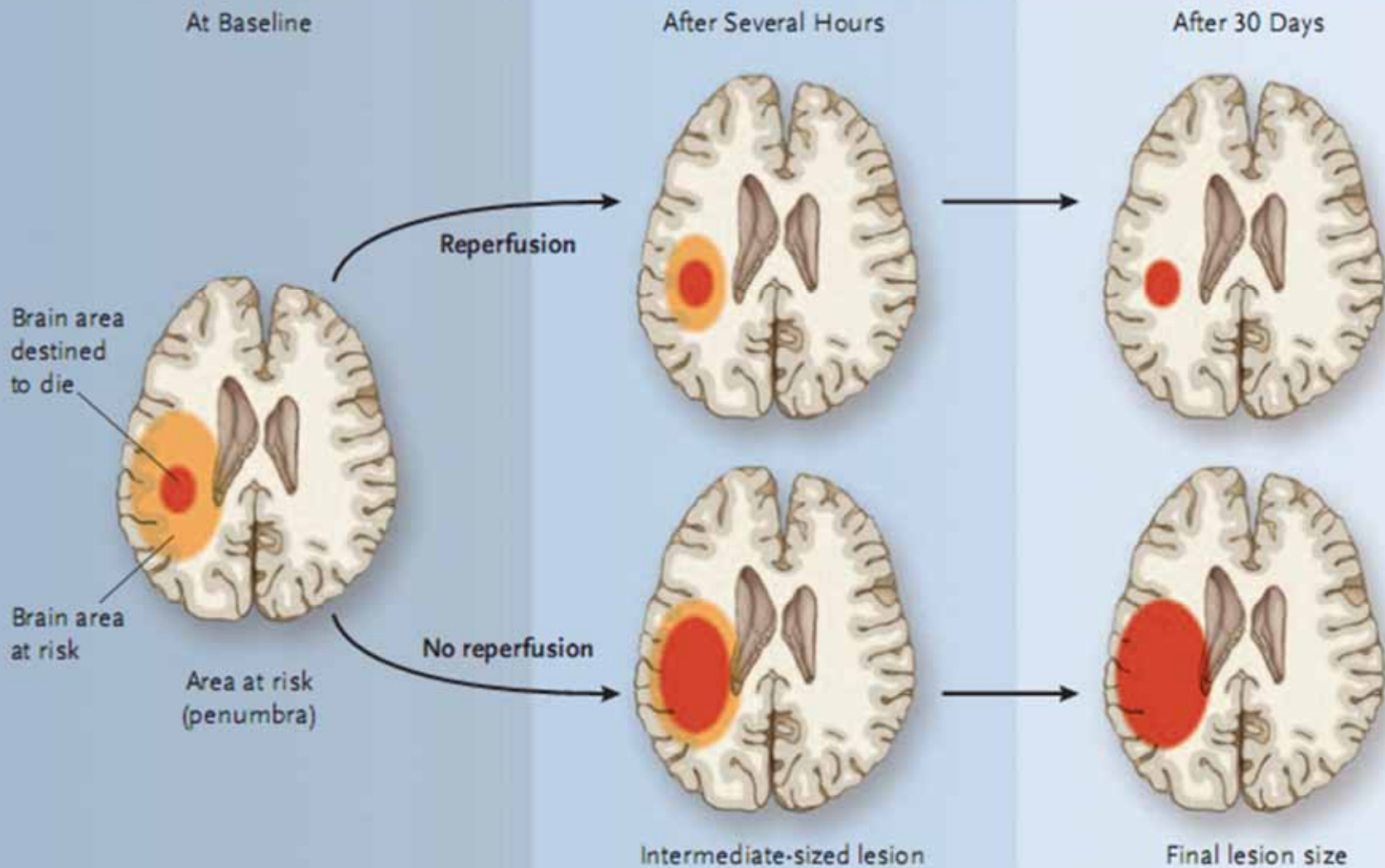
Diseases	1990	2000
Heart diseases <sup>2/</sup>	23.4	29.8
Cerebrovascular diseases	13.1	16.2
Diabetes Mellitus	5.1	4.6
Nephritis, nephrotic syndrome and nephrosis	3.2	3.1
Pneumonia	3.5	2.9
Cirrhosis of liver, liver abscess, chronic liver ideseases and its sequelae	2.3	2.9
Bronchitis (chronic & unspecified), emphysema and asthma	3.4	2.7
Hypertensive diseases	3.9	2.5
Senility without mention of psychosis	3.0	1.8
Septicaemia	1.0	1.1

1/ expressed as percentage over total deaths

2/ excluding "Acute rheumatic fever", "Hypertensive diseases"  
and "Diseases of the pulmonary circulation"



# Penumbra in Acute Stroke



# Ischemic Stroke

- ▣ Pre Hospital Management
- ▣ Emergency Evaluation and Diagnosis
- ▣ Brain Imaging
- ▣ Supportive Care and Treatment of Acute Complications
- ▣ Treatment of Ischemic Stroke
  - Intravenous Thrombolysis
- ▣ Hospital and General Acute Treatment
- ▣ Acute Neurological Complications



# Pre Hospital Management



# Pre Hospital Management

- ▣ Identification
- ▣ Focused history and assessment
- ▣ Necessary stabilization
- ▣ Transport immediately





# Cincinnati Prehospital Stroke Scale (Identification)



## Facial Droop

(have patient smile)

Normal:

Both sides of face move equally

Abnormal:

One side of face does not move as well



## Arm Drift

(have patient hold arms out for 10 seconds)

Normal:

Both arms move equally or not at all

Abnormal:

One arm drifts compared to the other, or does not move at all



## Speech

(have patient speak a simple sentence)

Normal:

Patient uses correct words with no slurring

Abnormal:

Slurred or inappropriate words, or mute

# F.A.S.T.

**NHS**

**FACE.**  
HAS THEIR FACE FALLEN ON ONE SIDE?  
CAN THEY SMILE?

**ARMS.**  
CAN THEY RAISE BOTH ARMS AND KEEP THEM THERE?

**SPEECH.**  
IS THEIR SPEECH SLURRED?

**TIME.**  
TIME TO CALL **999**  
IF YOU SEE ANY SINGLE ONE OF THESE SIGNS

[nhs.uk/actfast](http://nhs.uk/actfast)

## Act F.A.S.T.

### FACE

Does one side of the face droop?  
Ask the person to smile.

### ARMS

Is one arm weak or numb? Ask the person to raise both arms.  
Does one arm drift downward?

### SPEECH

Is speech slurred? Ask the person to repeat a simple sentence. Is the sentence repeated correctly?

### TIME

If the person shows any of these symptoms, CALL 911 or get to \_\_\_\_\_ Hospital immediately.

*F.A.S.T. information courtesy of the National Stroke Association.*

# Pre Hospital Management

## Do's

- ▣ Manage ABCs
- ▣ Cardiac monitoring
- ▣ Intravenous access
- ▣ Oxygen (O<sub>2</sub> sat < 92%)
- ▣ Assess for hypoglycemia
- ▣ Nil per oral
- ▣ Rapid transport
- ▣ Alert receiving ED

## Dont's

- ▣ Dextrose-containing fluids
- ▣ Hypotension/excessive blood pressure reduction
- ▣ Excessive intravenous fluids





# Emergency Evaluation and Diagnosis



# Evaluation

- ▣ Identify patients with possible stroke
- ▣ Exclude stroke mimic

## **Conversion disorder**

Lack of cranial nerve findings, neurological findings in a nonvascular distribution, inconsistent examination

## **Hypertensive encephalopathy**

Headache, delirium, significant hypertension, cerebral edema

## **Complicated migraine**

History of similar events, preceding aura, headache

## **Seizures**

History of seizures, witnessed seizure activity, postictal period

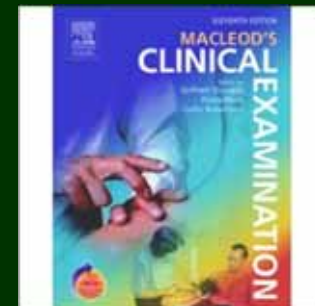
# Emergency Evaluation

## *History*

- ▣ The time of symptom onset
- ▣ Risk factors
- ▣ Historical data related to eligibility for therapeutic interventions

## *Physical Examination*

- ▣ General physical examination
- ▣ Neurological examination (NIH Stroke Scale)





# Diagnostic Tests

- ▣ Non contrast brain CT or brain MRI
- ▣ Blood glucose
- ▣ Serum electrolytes/renal function tests
- ▣ ECG
- ▣ Complete blood count
- ▣ Prothrombin time (INR)
- ▣ Activated partial thromboplastin time
- ▣ Oxygen saturation



# Brain Imaging

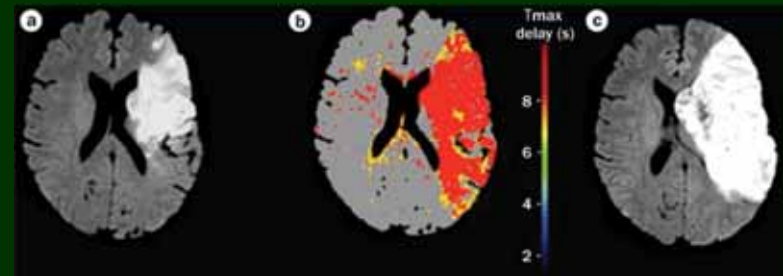
## *Non-Contrast-Enhanced CT Scan of the Brain*

- ▣ Criterion standard
- ▣ Door to CT time 25 minutes
- ▣ Door-to-interpretation time of 45 minutes

## *Multimodal CT*

## *Multimodal MRI*

- ▣ DWI – very good - ischemic lesions
- ▣ PWI - measure relative blood flow in the brain



# Brain Imaging

## *Non-Contrast-Enhanced CT Scan of the Brain*

- ▣ criterion standard
- ▣ insensitive –
  - acute infarctions
  - small cortical or subcortical infarction
  - posterior fossa infarctions
- ▣ early signs of ischemic brain injury
- ▣ > signs of early infarction > risk of hemorrhagic transformation
- ▣ Door to CT time 25 minutes
- ▣ door-to-interpretation time of 45 minutes



# Early signs



Hyperdense vessel sign

# Brain Imaging

## ***Multimodal CT***

- ▣ Noncontrast CT
- ▣ Perfusion CT
  - ▣ Whole brain perfusion CT
  - ▣ Dynamic perfusion CT
- ▣ CT angiography

# Brain Imaging

## ***Multimodal MRI***

- ▣ T1, T2 weighted & proton density relatively insensitive
- ▣ Diffusion weighted imaging – very good - ischemic lesions
- ▣ Perfusion weighted imaging - measure relative blood flow in the brain
- ▣ diffusion–perfusion mismatch = ? ischemic penumbra
- ▣ MRI is as accurate as CT in detecting hyperacute intraparenchymal hemorrhage
- ▣ MR angiography

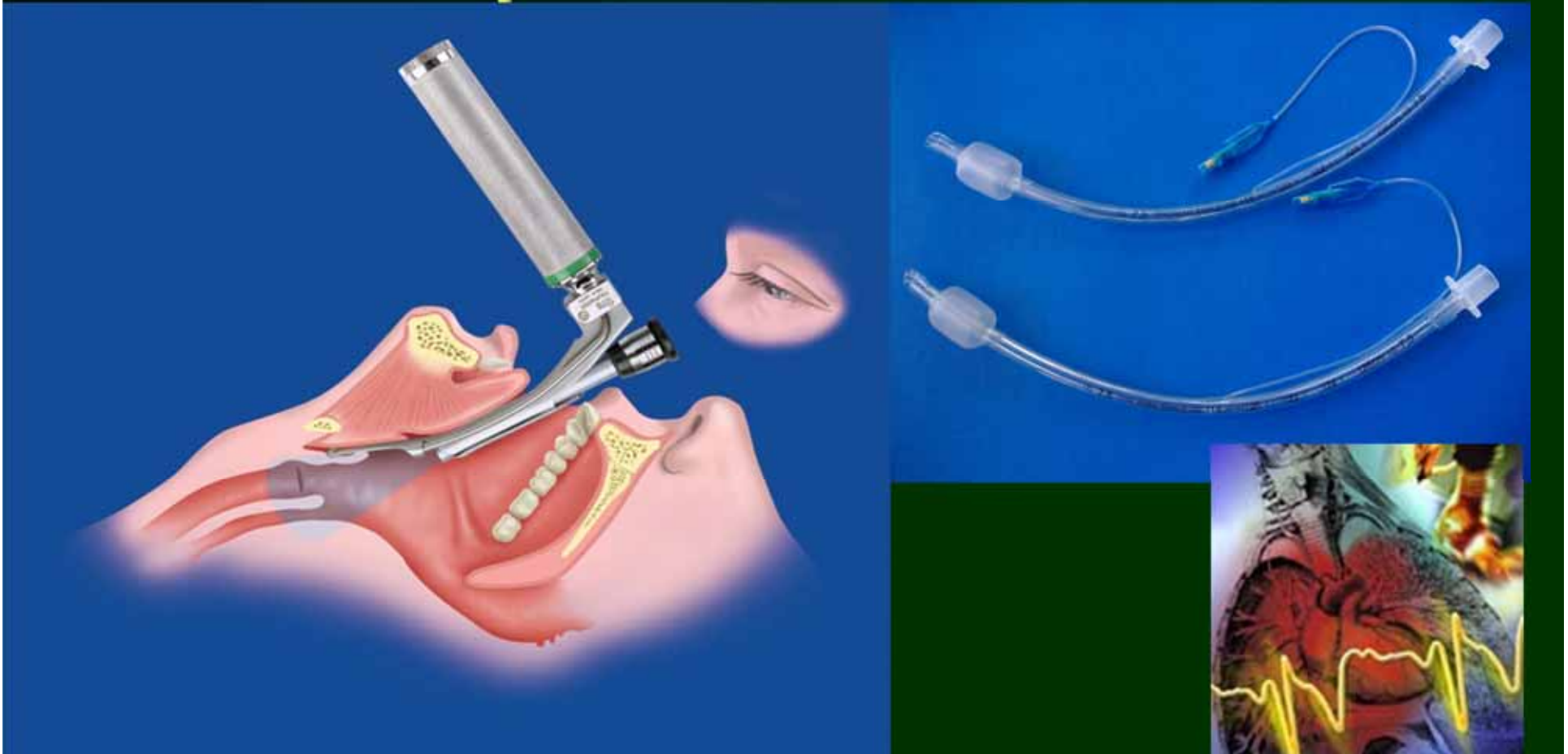
# Brain Imaging

## ***Other Vascular Imaging***

- ▣ Transcranial Doppler ultrasonography
- ▣ Carotid duplex sonography
- ▣ Catheter angiography

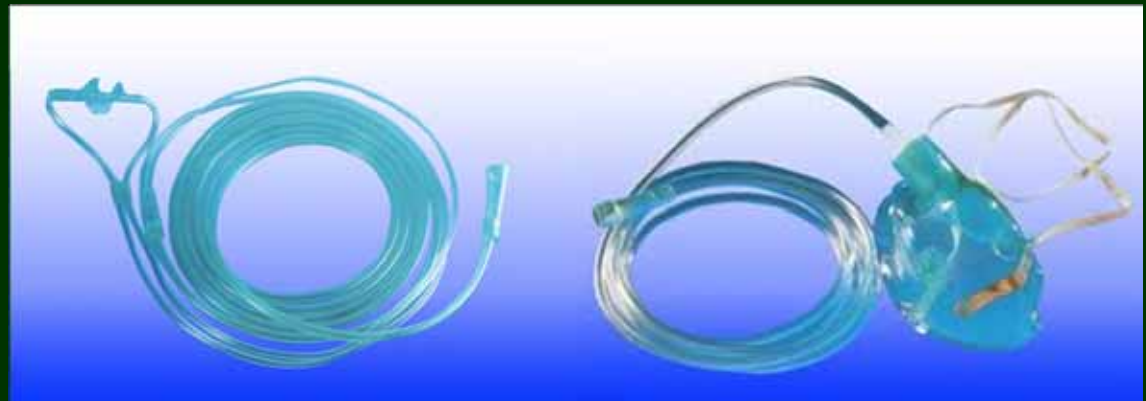


# Supportive Care and Treatment of Acute Complications



# Airway, Ventilatory Support, and Oxygen

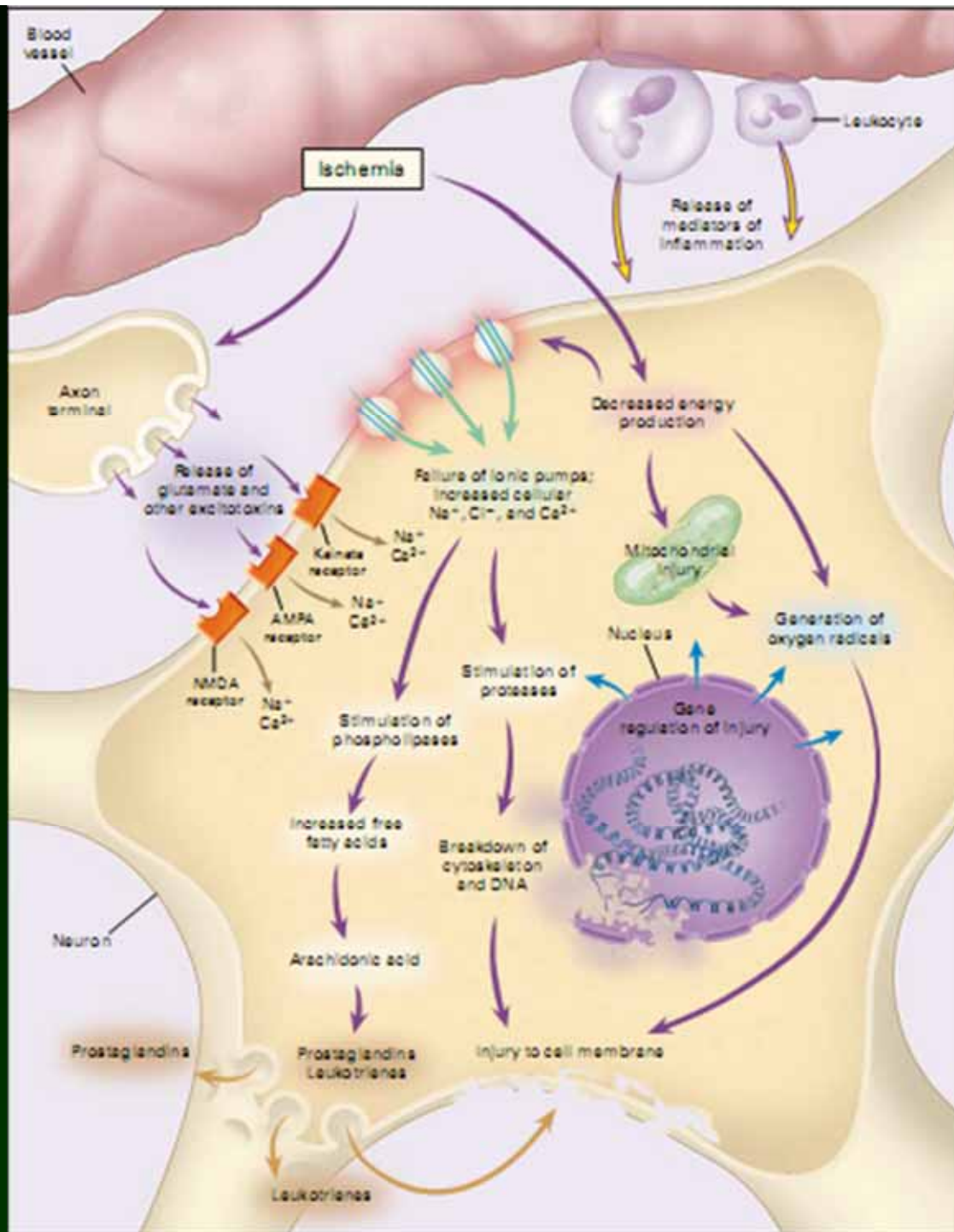
- ▣ Airway support and ventilatory assistance
  - ▣ Decreased consciousness
  - ▣ Bulbar dysfunction causing compromise of the airway
- ▣ Oxygen for hypoxic patients (Target saturation  $\geq 92\%$ )
- ▣ Most patients do not need supplemental oxygen



# Temperature

- ▣ Fever during acute stroke is associated with poor neurological outcome
  - Increased metabolic demands
  - Enhanced release of neurotransmitters
  - Increased free radical production
- ▣ Sources of fever should be treated
- ▣ Antipyretic medications - neurological outcomes??







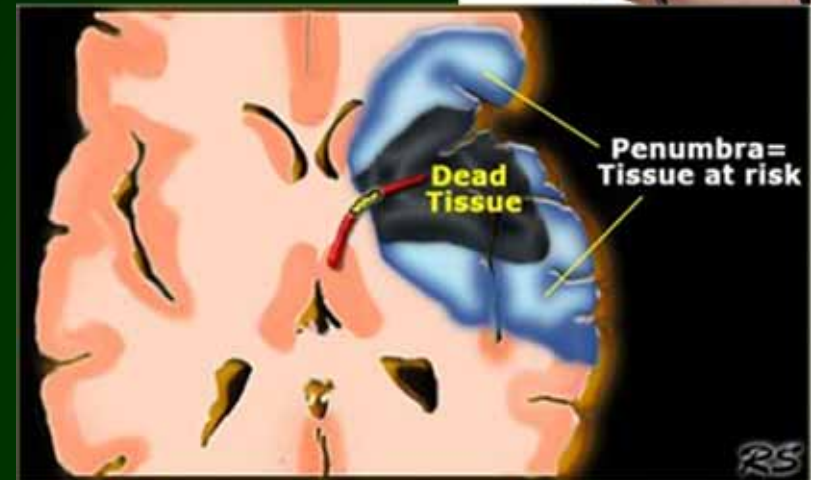
# Cardiac Monitoring

- ▣ Complications of CVA
  - Myocardial ischemia
  - Cardiac arrhythmias
- ▣ Infarctions of the right hemisphere (insula)
  - ↑risk of cardiac complications
- ▣ Cardiac enzymes/ ECG - to R/O ischemia
- ▣ Cardiac monitoring for at least the first 24 hours
- ▣ Serious cardiac arrhythmia should be treated



# Arterial Hypertension

- ▣ Controversial
- ▣ Data - inconclusive / conflicting
- ▣ Cautious approach
- ▣ No Antihypertensives unless
  - SBP >220 mm Hg
  - DBP > 120 mm Hg
- ▣ lower blood pressure by ~15% during the first 24/h
- ▣ High blood pressure increased risk of hemorrhagic transformation in *patients treated with rtPA*



# Treatment of Hypertension in patients eligible for rtPA

## ▣ Target

- Systolic  $>185$  mm Hg
- Diastolic  $>110$  mm Hg



▣ Labetalol -10 to 20 mg IV over 1 to 2 minutes

▣ Nicardipine - 5 mg/h IVI, titrate 2.5 mg/h every 5 - 15 minute

▣ If blood pressure remains  $> 185/110$  mm Hg

***do not administer rtPA***

# Hypertension during and after treatment with rtPA

- ▣ Maintain Blood pressure level -
  - Systolic 180
  - Diastolic 105
- ▣ Labetalol 10 mg IV - infusion at 2 to 8 mg/min
- ▣ Nicardipine infusion - 5 mg/h Max 15 mg/h
- ▣ If BP not controlled - sodium nitroprusside

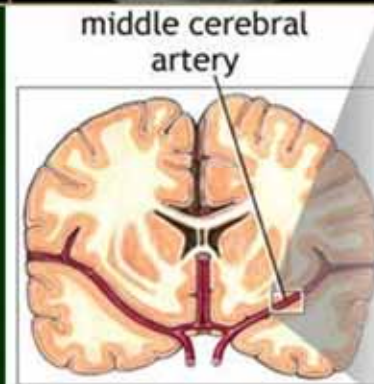
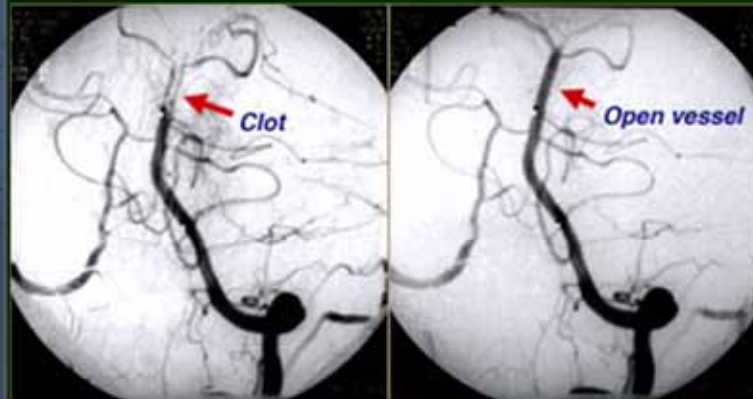


# Arterial Hypotension

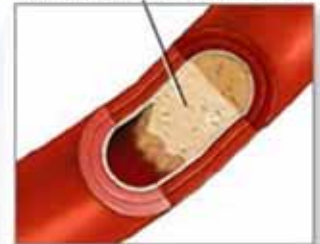
- ▣ Unfavorable outcome if BP < 100/70 mm Hg
- ▣ Volume replacement
- ▣ Correction of cardiac arrhythmia
- ▣ Vasopressors
  
- ▣ Hypoglycemia
- ▣ Hyperglycemia
  - Treat if > 180 mg/dL



# Intravenous Thrombolysis



Atherosclerotic clot



Blood clot



# Intravenous Thrombolysis

- ▣ Timely thrombolytic therapy is the most effective treatment for stroke
- ▣ Limited time frame
- ▣ Benefit of thrombolysis decreases over time



# Intravenous Thrombolysis

- ▣ Major Questions before thrombolytic therapy
- ▣ Risks and benefits
- ▣ When is the treatment too late
- ▣ When is the use of thrombolytic agents too dangerous



# History

- ▣ ATLANTIS
- ▣ ECASS 1
- ▣ ECASS 2
- ▣ No benefit with rtPA
- ▣ Used higher doses of rtPA
- ▣ Time window upto 6 hours
- ▣ No control of hypertension
- ▣ Much higher intracranial haemorrhage in the treatment group





# NINDS STROKE TRIAL

## The New England Journal of Medicine

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**TISSUE PLASMINOGEN ACTIVATOR FOR ACUTE ISCHEMIC STROKE**

THE NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE rt-PA STROKE STUDY GROUP\*

# NINDS STROKE TRIAL

- ▣ Treatment of acute ischemic stroke within 3 hours
- ▣ 624 patients randomly assigned
- ▣ IV alteplase 0.9 mg/Kg upto 90 mg/Kg
- ▣ 10 % as bolus- rest over 60 minutes
- ▣ Approximately half within 90 minutes
- ▣ Ten fold increase in ICH among alteplase group ( 6.4% versus 0.6%)
- ▣ Still mortality was not different among two groups
- ▣ At 3 months recovery better in patients given alteplase ( 38% versus 21% )

# Intravenous Thrombolysis

- ▣ Benefits of IV thrombolytic therapy persisted on 1 year follow-up
- ▣ Patients treated within 90 minutes had better outcome
- ▣ FDA approved the use of intravenous rtPA in 1996
- ▣ European Medicines Evaluation Agency granted license for the use of rtPA- 2002

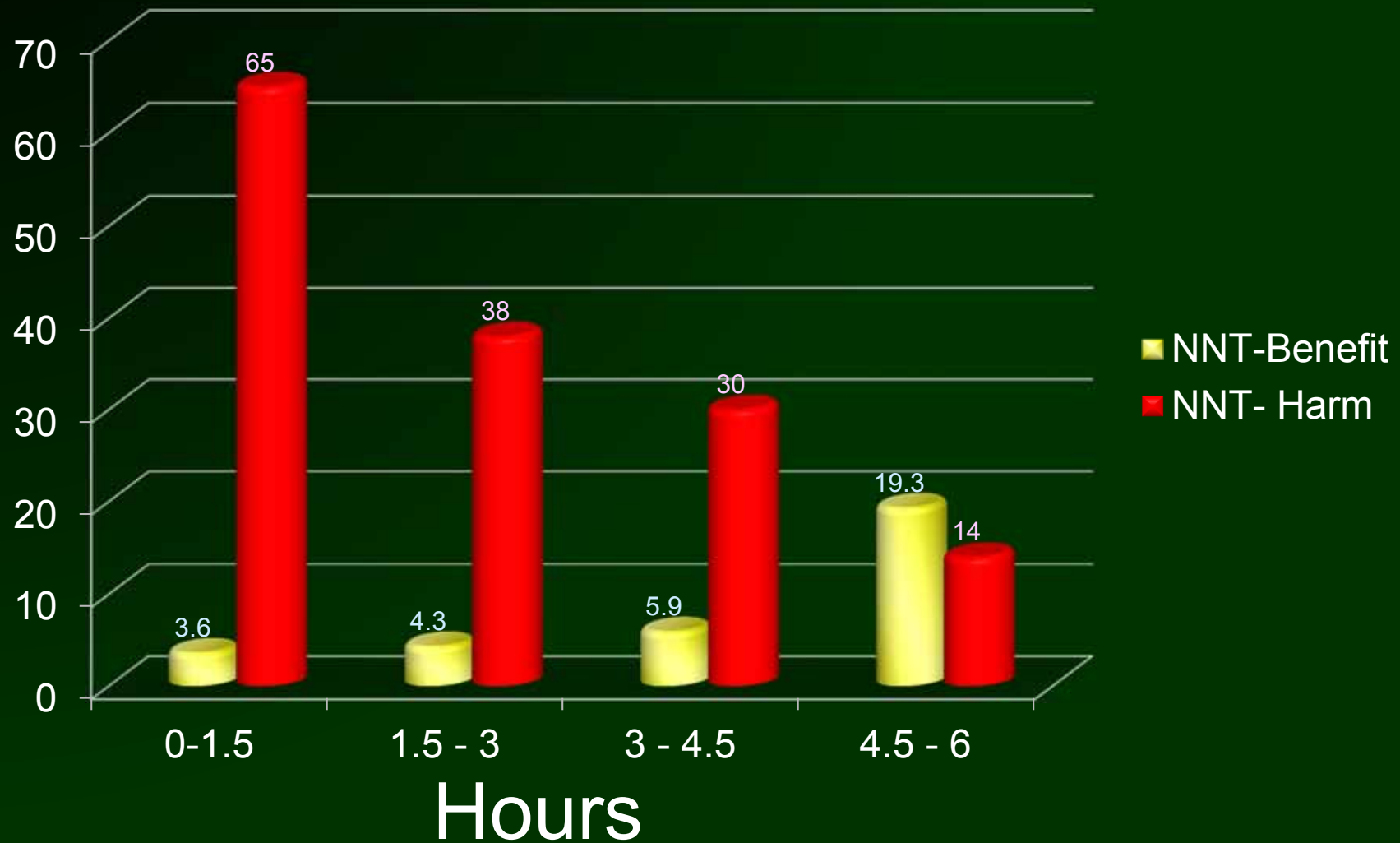


# Intravenous Thrombolysis

- ▣ 3 hour time frame - short ?
- ▣ Pooled data from studies analysed showed possibility of benefit till 4.5 hours

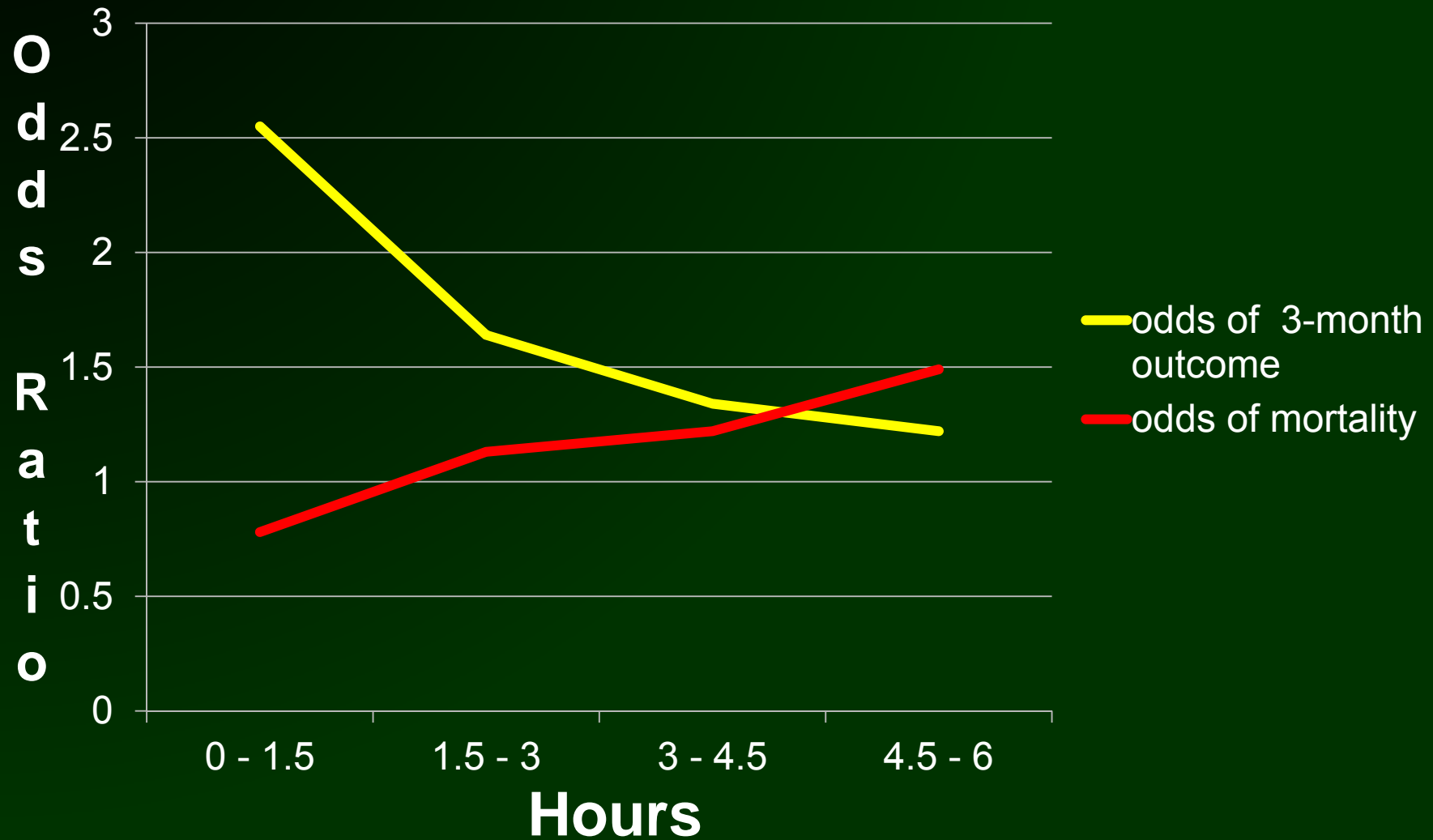


# NNT for Benefit & Harm





# Pooled analysis



# ECASS 3

- ▣ 821 patients (18- 80 yrs)
- ▣ Treatment from 3- 4.5 hrs
- ▣ Had some extra exclusion criteria
  - Patients more than 80 yrs old
  - NIHSS score > 25
  - Combination of previous stroke and diabetes
  - Patients on anti-coagulants
- ▣ Initial stroke severity milder than NINDS trial

# ECASS 3

- ▣ Better outcome with alteplase than placebo ( 52% vs 45%)
- ▣ No difference in mortality
- ▣ Symptomatic ICH more with alteplase ( 2.2% vs 0.2%) (7.9% vs 3.5% using NINDS criteria)
- ▣ In 2009 AHA expanded time window to 4.5 hrs

# Eligibility for rtPA

## Inclusion criteria

- ▣ Clinical diagnosis of ischemic stroke
- ▣ Time frame for thrombolysis from onset of symptoms < 4.5 hrs
- ▣ If time of onset is unknown - last time patient was known to be normal



# Exclusion Criteria

## Historical

- ▣ Stroke or head trauma – last 3 months
- ▣ Any history of ICH
- ▣ Major surgery - last 14 days
- ▣ MI – last 3 months
- ▣ Non-compressible arterial puncture – last 7 days

## For treatment from 3- 4.5 hrs

- ▣ Age > 80 yrs
- ▣ Combination of stroke and diabetes





# Exclusion Criteria



## Clinical

- ▣ Spontaneously clearing stroke symptoms
- ▣ Minor neurological signs
- ▣ Seizure at stroke onset - ? Postictal
- ▣ Symptoms suggestive of SAH
- ▣ Persistent BP elevation ( $> 185/110$  mmHg)
- ▣ Active bleeding or acute trauma

## For treatment from 3- 4.5 hrs

- ▣ NIH stroke scale  $> 25$

# Exclusion Criteria

## Laboratory

- ▣ Platelets  $< 100,000 \text{ mm}^3$
- ▣ Serum glucose  $< 50 \text{ mg/dL}$  ( $< 2.8 \text{ mmol/L}$ )
- ▣ INR  $> 1.7$  if on oral anti- coagulants
- ▣ Elevated APTT

## For treatment from 3- 4.5 hrs

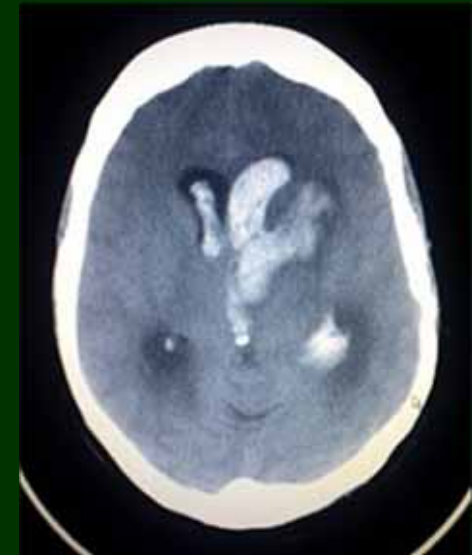
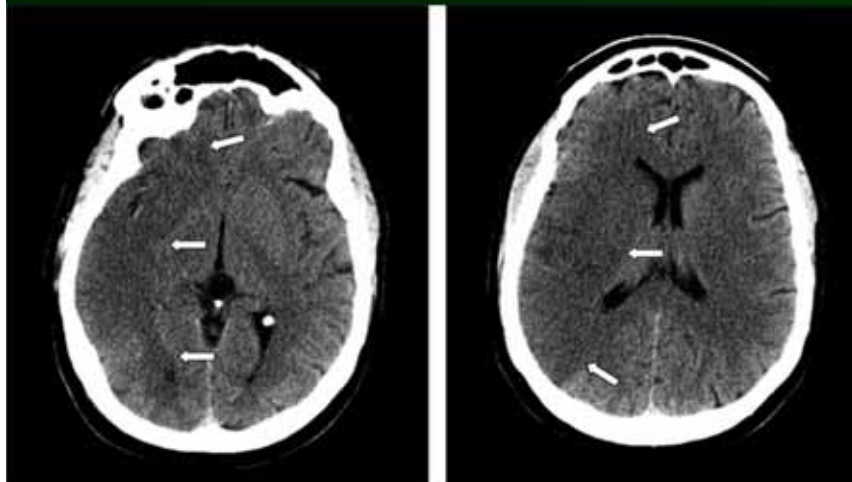
- ▣ Use of oral anti- coagulants



# Exclusion Criteria

## Brain Imaging

- ▣ Hemorrhage
- ▣ Evidence of multilobar infarction ( hypodensity > 33% of cerebral hemisphere)



# Intravenous Administration of rtPA

- ▣ Infuse 0.9 mg/kg (maximum dose 90 mg) over 60 minutes
  - 10% of the dose given as a bolus over 1 minute
- ▣ Admit the patient to ICU
- ▣ Neurological assessments every 15 minutes during the infusion
- ▣ Every 30 minutes for the next 6 hours then hourly until 24 hours
- ▣ BP every 15 minutes for the first 2 hours 30 minutes for the next 6 hours, then hourly
- ▣ Antihypertensive medications to maintain BP



# Other Thrombolytic Agents

- ▣ Clinical trials of streptokinase were halted prematurely - high rates of haemorrhage
- ▣ Tenecteplase and Desmoteplase appear promising
- ▣ None of the other agents have been tested extensively



# Thrombolysis in a nutshell

- ▣ Time frame for thrombolysis upto 4.5 hrs
- ▣ Efficiency of thrombolysis decreases with time
- ▣ Side effects increases with time
- ▣ Meticulous maintenance of BP needed if patient is thrombolysed
- ▣ Streptokinase should not be used



# Anticoagulants

- ▣ Multiple trials – Heparin & LMWH
- ▣ No benefit in -
  - Preventing early recurrent stroke
  - Halting neurological worsening
  - Improving outcomes
  - Increased risk of serious ICH
- ▣ **Not recommended**



# Antiplatelet Agents

- ▣ Aspirin – the only oral antiplatelet agent evaluated for ischemic stroke
- ▣ Two large trials
- ▣ Trend in reduction in death or disability
- ▣ Modest but statistically significant benefit from aspirin (pooled data)
- ▣ Prevention of recurrent events
- ▣ Ticlopidine, clopidogrel, dipyridamole - not been evaluated in acute ischemic stroke

# Antiplatelet Agents

- ▣ Aspirin (initial dose is 325mg) within 24 to 48 hours after stroke is recommended
- ▣ Do not give aspirin as an adjunctive therapy within 24 hours of thrombolytic therapy
- ▣ Clopidogrel - not recommended

# Hospital and General Acute Treatment



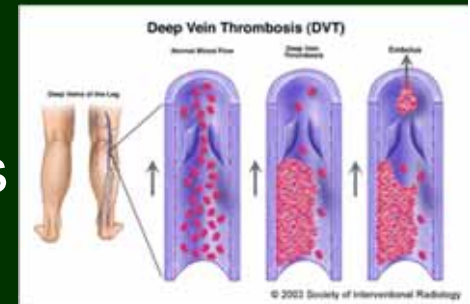


# General Treatment

- ▣ Early mobilization
- ▣ Assess swallowing before starting eating or drinking
- ▣ NG or PEG feeds for hydration and nutrition in patients who cannot take food and fluids orally
- ▣ Suspected pneumonia or UTI should be treated with antibiotics

# General Treatment

- ▣ Anticoagulants for treatment of immobilized patients to prevent DVT
- ▣ Patients who cannot receive anticoagulants
  - Aspirin
  - Intermittent external compression devices
- ▣ Prophylactic administration of antibiotics is not recommended
- ▣ Indwelling bladder catheters should be avoided if possible



# Acute Neurological Complications



# Neurological Complications

- ▣ Brain Edema & Increased ICP
- ▣ Hemorrhagic Transformation
- ▣ Seizures



**THANK YOU**





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Devoted to Caring

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