

EFNS Regional Teaching Course



MANAGEMENT OF ISCHEMIC STROKE

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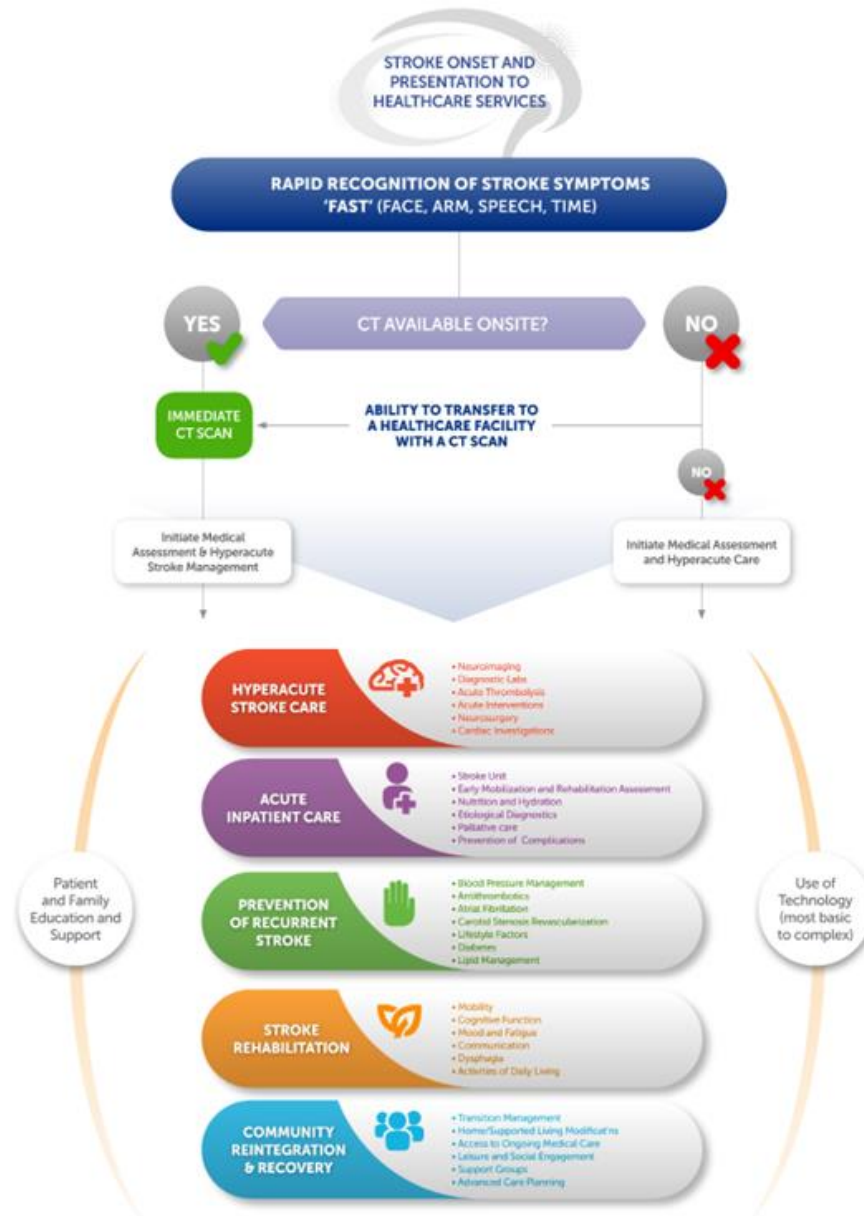
Portugal

TREATMENT OF ACUTE STROKE

Stroke is treatable!

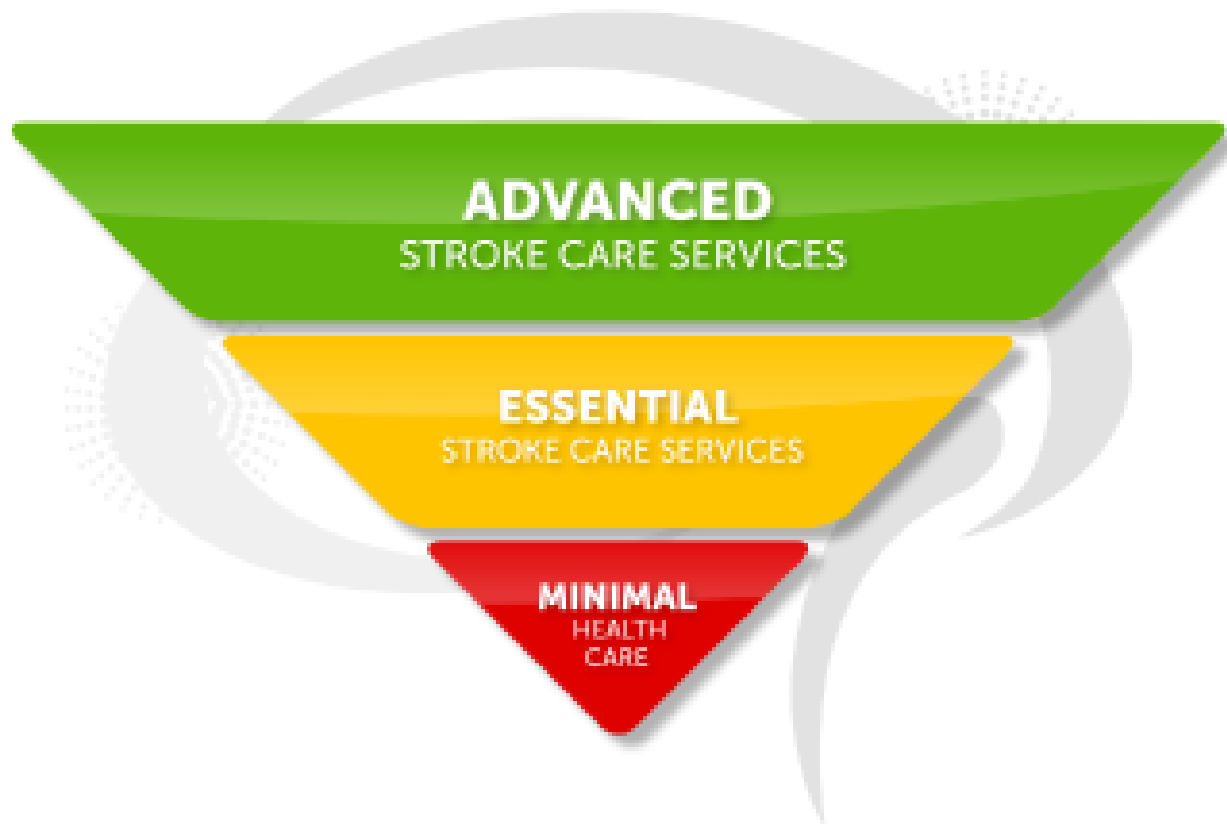
- Acute ischemic stroke
 - is one of the commonest neurological emergencies
 - has a high associated mortality and dependence rate
 - can be treated
- Neurologists should be competent to manage acute ischemic stroke from emergency admission to hospital discharge

GLOBAL STROKE ACTION PLAN FRAMEWORK



World Stroke Organization Global Stroke Services Guidelines and Action Plan

LEVELS OF HEALTH SERVICE CAPACITY FOR STROKE CARE*



World Stroke Organization Global Stroke Services Guidelines and Action Plan

Health services capacity for stroke care checklist

Advanced stroke services

- Access to advanced diagnostic services
- Access to physicians with stroke expertise
- Access to advanced interventions in addition to tPA, such as interventional radiology and neurosurgery
- Access to specialist rehabilitation therapists
- Access to community programs for recovery after stroke
- Fully coordinated stroke care provided across geographically discrete regions

Essential stroke services

- Access to basic diagnostic services – laboratory, ECG, CT scan, ultrasound
- Access to nurses
- Access to physicians, although may not be stroke specialists
- Access to acute thrombolysis with tPA
- Access to elements of stroke unit care, including members of an interdisciplinary stroke team
- Access to rehabilitation services
- Access to stroke prevention therapies such as aspirin, lifestyle change recommendations, blood pressure management
- Limited coordinated stroke care provided across geographically discrete regions

Minimal healthcare services

- Variable access to healthcare workers (nurses or lay workers)
- Very limited access to physicians
- No access to diagnostic services or hospital care
- Limited access to the most basic lifestyle preventative advice
- Care provided in local communities without coordination across defined geographic regions

*These checklists should be used for self-assessment and for stroke services planning. The goal is to achieve as many checkmarks as possible and continually strive to provide the highest level of stroke services that is realistically and reasonably attainable, given local and regional resources and circumstances.

CT, computed tomography; ECG, electrocardiogram; tPA, tissue plasminogen activator.

ACUTE STROKE CARE

Scenario 1

- Rural community with a visiting health worker
 - Limited access to physicians
 - Variable access to health workers
 - No access to diagnostic tests or hospital care
 - Access to internet



ACUTE STROKE CARE

Scenario 2 – minimum health care services

- Community with health clinic
 - Limited access to physicians
 - Variable access to health workers
 - Limited access to diagnostic tests or hospital care
 - Variable access to medication
 - Access to internet



ACUTE STROKE CARE

Scenario 3 – essential stroke services

- Community hospital with access to essential stroke services
- (Primary stroke center)



ACUTE STROKE CARE

Scenario 3 – essential stroke services

- Community hospital with access to essential stroke services
- (Primary stroke center)
- Basic diagnostic tests
 - Lab, ECG, CT
 - Ultrasound (echo, Doppler)
- Nurses with stroke training
- Physicians with stroke expertise
- Inpatient stroke care
- Access to rehabilitation
- Access to stroke prevention
- Stroke training program



ACUTE STROKE CARE

Scenario 4 – advanced stroke services

- Large urban hospital with advanced stroke services
- (Comprehensive stroke center)
- Advanced diagnostic services
 - MR, angiography
- Expert physicians
 - Neurologist, neurosurgeon, neuroradiologist
- Multiprofessional stroke team
- Stroke unit care
- Coordinated care intra- and between hospitals
- Coordinated referral system
- Stroke training program



CASE 1

Recognition and reaction to stroke symptoms

- 69 year old male, smoker, with hypertension and treated hypelipidemia and diabetes
- Sudden onset of left hemiparesis, facial assymetry and dysarthria while eating (1:20 am)
- Wife called **112** at 1:25

O AVC É UMA EMERGÊNCIA MÉDICA

O Acidente Vascular Cerebral (AVC) é frequentemente a morte de uma parte do cérebro, causada pelo entupimento de uma artéria. Os doentes com sinais de AVC devem ser transportados para um hospital com unidade especializada no tratamento desta doença. A intervenção médica especializada é vital para o sucesso do tratamento e posterior recuperação do doente.

CONHEÇA OS SINAIS DE ALARME!

Aparecimento súbito de:

- FALTA DE FORÇA NUM BRAÇO
- BOCA AO LADO
- DIFICULDADE EM FALAR

Na presença destes sinais de alarme...
Não perca tempo
LIGUE DE IMEDIATO 112

Não recorra ao hospital pelos seus próprios meios!

O **INEM** orientará os doentes para o hospital adequado, onde o diagnóstico será confirmado e o tratamento efectuado.

Se estes sinais forem reconhecidos a tempo,
ligar 112 é a forma mais rápida de ser tratado.

Colabore na divulgação desta informação!

SEJA MAIS RÁPIDO QUE UM AVC

LIGUE DE IMEDIATO 112

Boca ao lado

Falta de força num braço



CASE 1 – rapid transportation of the stroke victim

- Wife called 112 at 1:25
- Ambulance arrived at 1:32
- Paramedics evaluation
 - Left hemiparesis and dysarthria
 - BP 103-100 mmHg, pulse 63 regular, blood glucose 109 mg/dl
- Ambulance left Foz do Arelho to Santa Maria Hospital (HSM) at 2:00
- Paramedics called HSM Stroke Pathway “Via verde” mobile
- Patient arrived at HSM Emergency at 2:52



CASE 2

call 112!

- 75 year French old male, visiting Portugal
- Prosthetic mechanical mitral valve, CABG, treated hypertension and hyperlipidemia
- On aspirin, sotalol and statin
- Sudden onset of left hemiparesis (19:20)
- 112 called
- Stroke pathway “Via Verde” activated
- Patient arrived at HSM Emergency 1 h after onset

STROKE PATHWAY

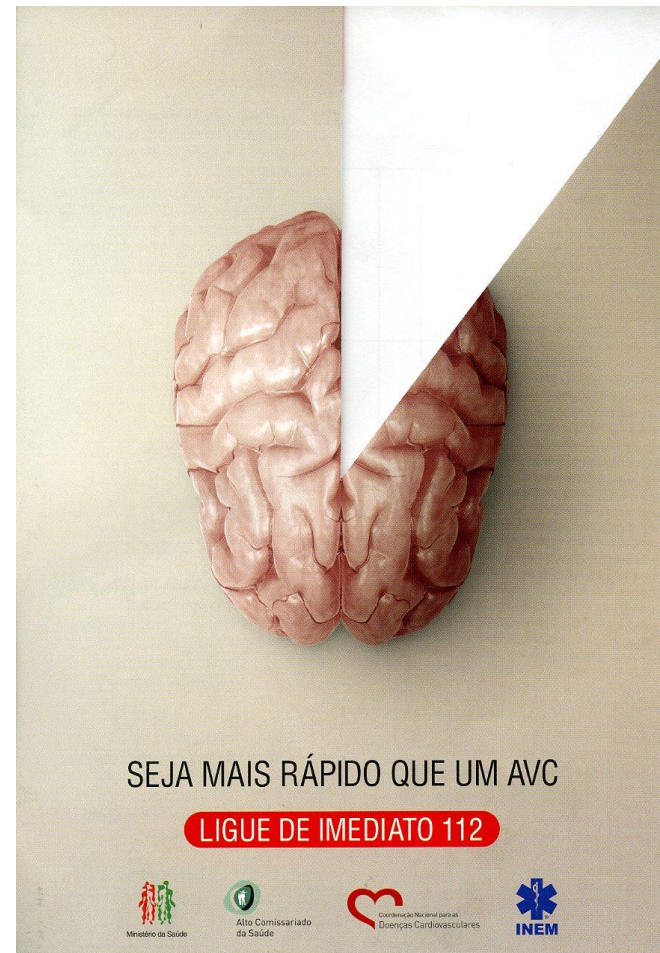
“VIA VERDE PARA O AVC”

If stroke is suspected, how should the stroke victim or his proxy react?

**If a stroke is suspected
call 112 immediately**

Do not
Wait for symptoms to improve
Wait for a proxy
Call health worker

**Go the nearby health centre that
can provide stroke care**



Ischemic stroke? Candidate for IV thrombolysis? For thrombectomy?

- Neurologist on duty
 - NIHSS – 11
 - BP 142/87
 - CT – no early infarct signs
 - CT angio – no proximal occlusion
 - No contraindications for rtPA
 - ECG premature beats
 - Started rtPA bolus at 4:30 (180m)
 - Finished perfusion at 5:27
 - NIHSS - 7

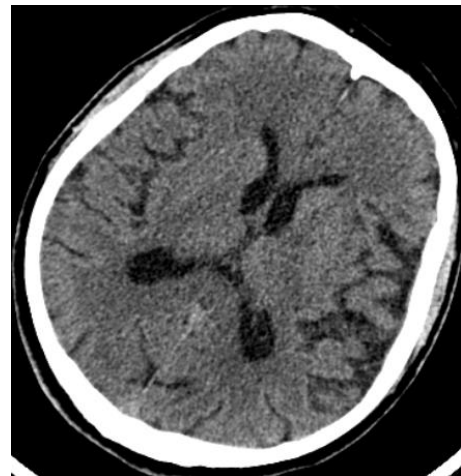
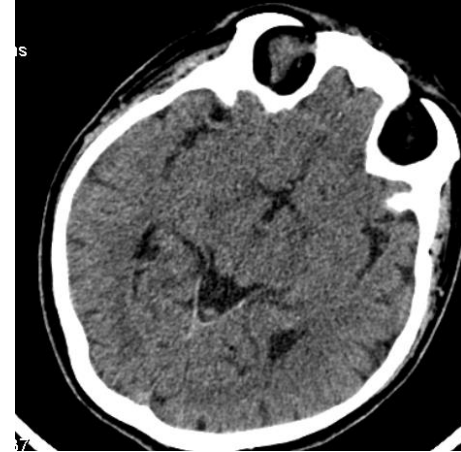


CASE 2

Ischemic stroke?

Candidate for thrombolysis/thrombectomy?

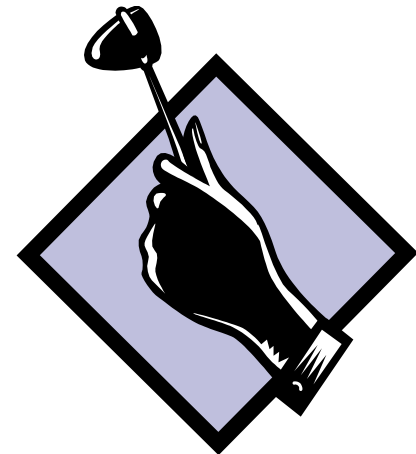
- Neurologist on duty
 - NIHSS – 14, GCS - 11
 - BP 185/95 mmHg
 - Blood glucose 144 mg/dl
 - ECG sinus rhythm
 - CTA: no proximal occlusion
 - No contraindications for rtPA
 - Started rtPA bolus 130m after onset
 - When perfusion finished - NIHSS - 14



TREATMENT OF ACUTE STROKE

hyperacute evaluation

- Examination at the ER (<30 m)
 - ABC, vital signs, time of onset or when last seen well
 - General and neurological exam
 - NIHSS
- Candidate for thrombolysis?
 - <4.5 h
 - Check list of contraindications
 - ~ body weight
- Candidate for thrombectomy?
 - <6h
 - Proximal occlusion: ICA, MCA M1
 - NIHSS > 5, ASPECTS >5



TREATMENT OF ACUTE STROKE

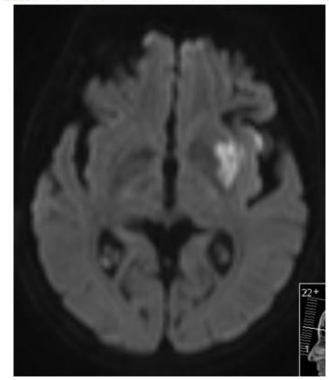
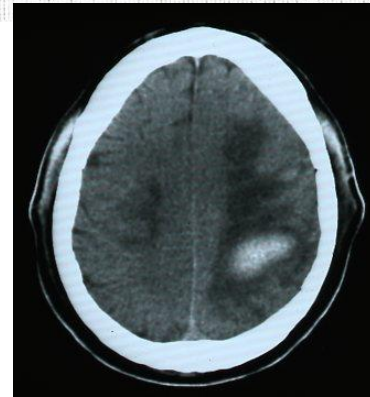
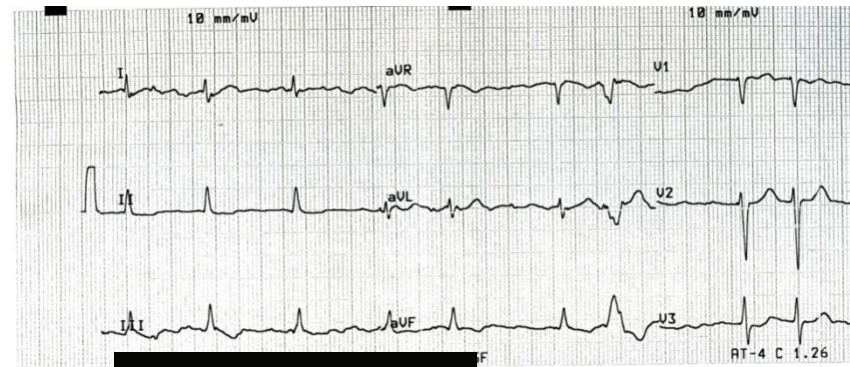
Stroke mimics

- Somatoform disorders
- Focal vascular seizures
- Migraine with aura
- Peripheral vertigo
- Peripheral facial palsy
- Brain tumor
- Subdural hematoma

TREATMENT OF ACUTE STROKE

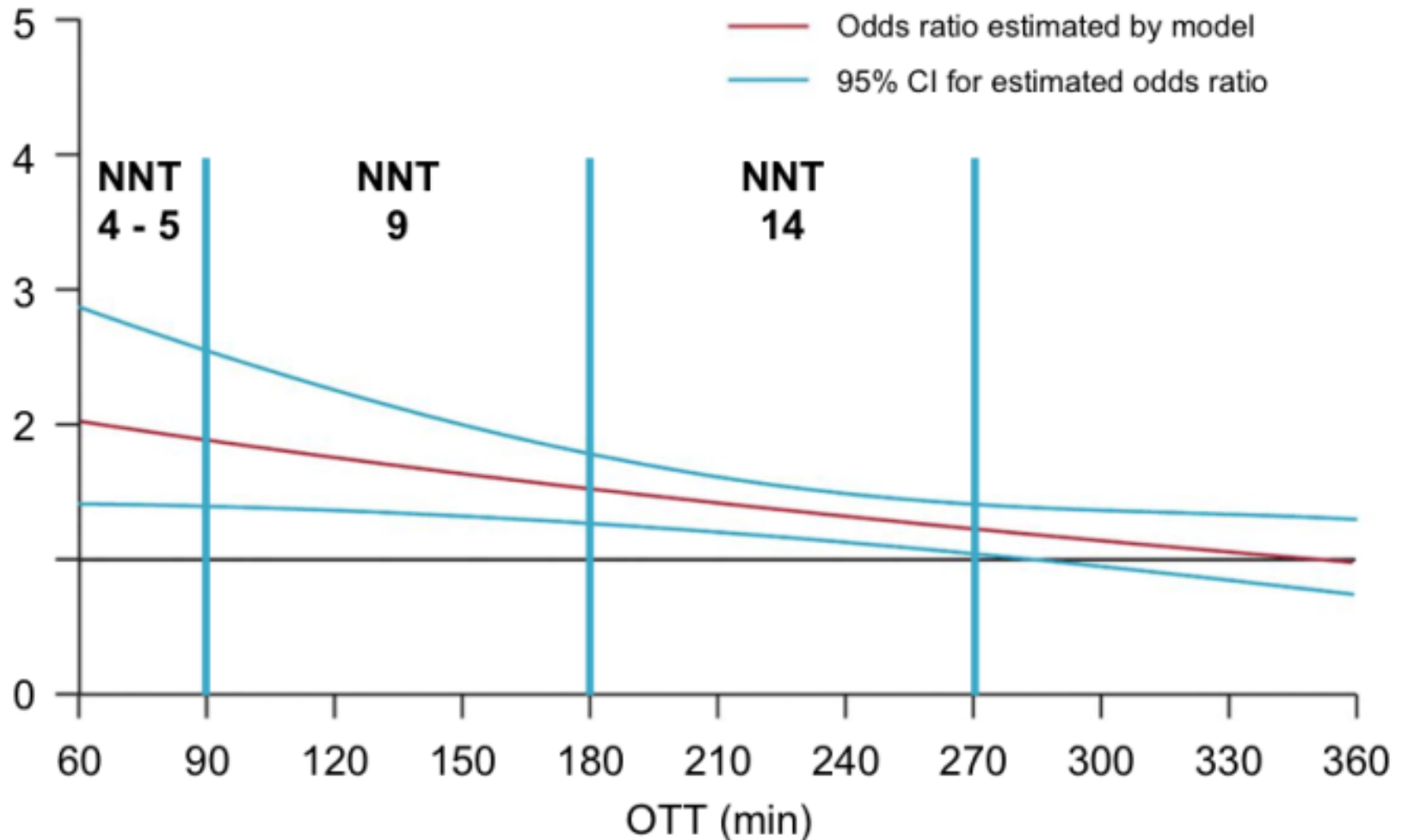
hyperacute evaluation

- Blood sample (<20 m)
 - blood cell count, platelets, INR, aPPT, glucose
- ECG
- Brain CT (results <45m)
- MR DWI (alternative)
- CT Angiography (if thrombectomy possible)



"Time is brain"

Numbers needed to treat (NNT) to reach a modified Rankin score of 0-1



TREATMENT OF ACUTE STROKE

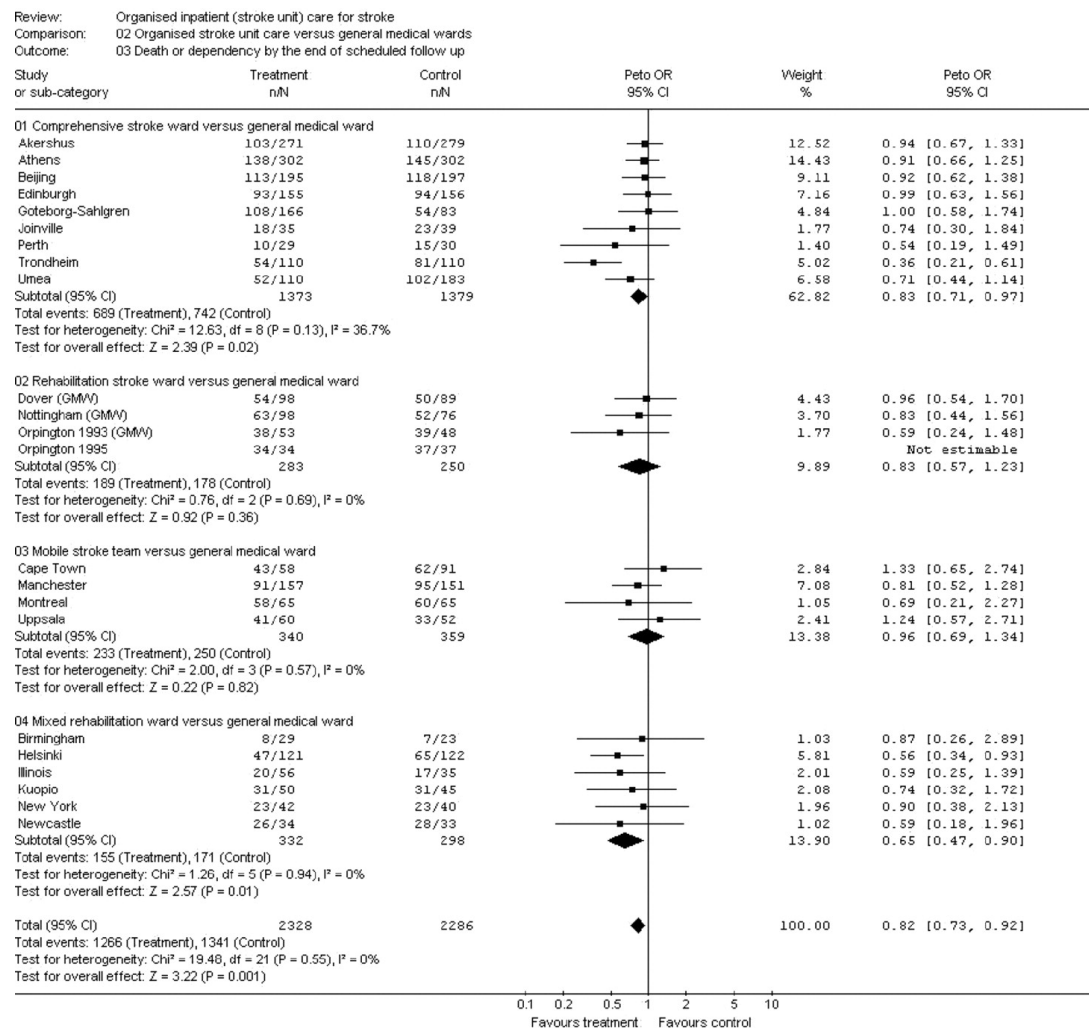
After IV thrombolysis

- Continue to monitor
 - Neurological status, BP and bleeding
- No antiplatelets or anticoagulants for 24 h
- No bladder catheterization < 30m
- Avoid nasogastric tube for 24 h
- Avoid central catheters and arterial punctures for 24 h

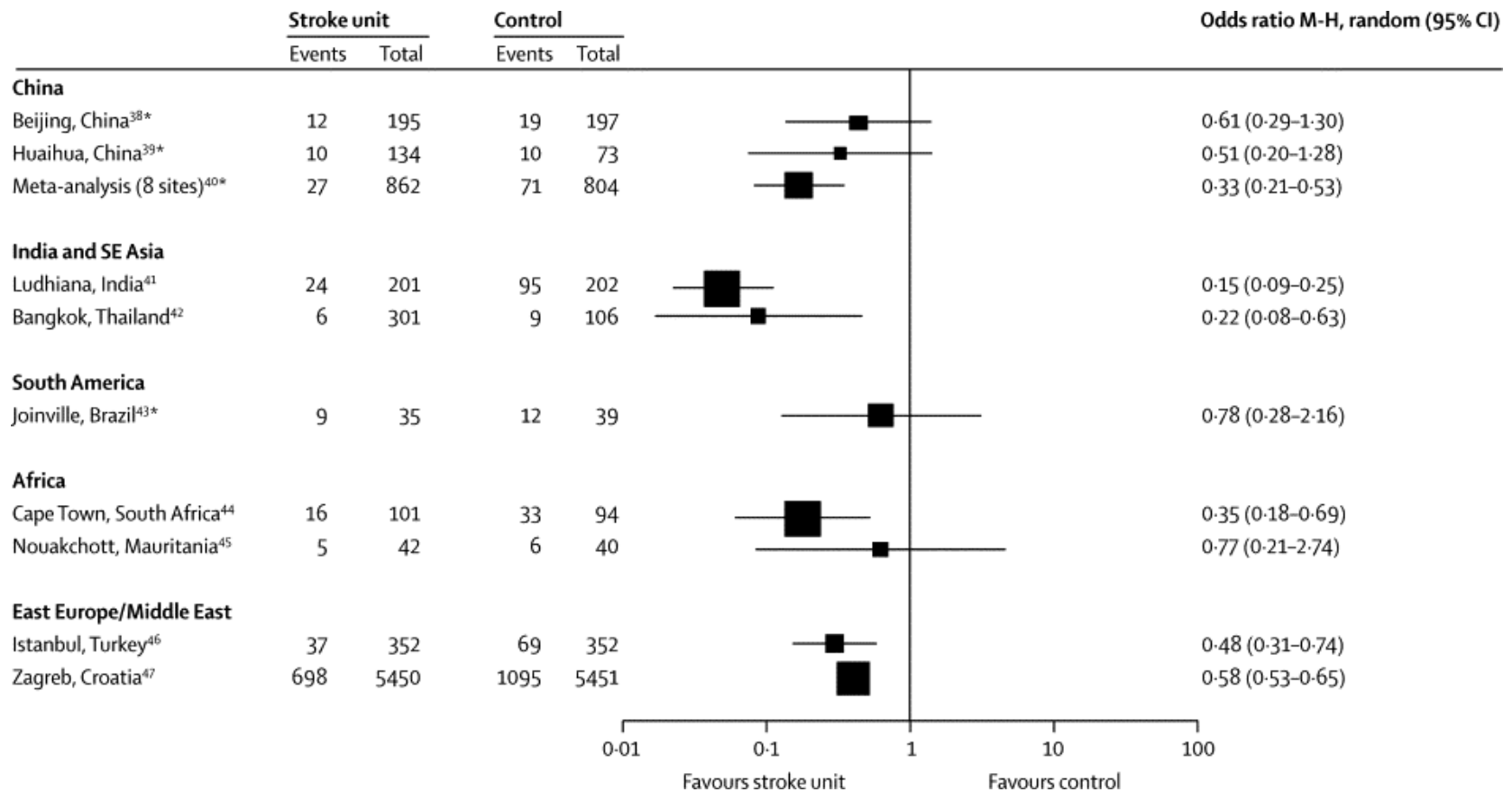
WHERE SHOULD STROKE PATIENTS BE ADMITTED? TO STROKE UNITS!

• Stroke Units

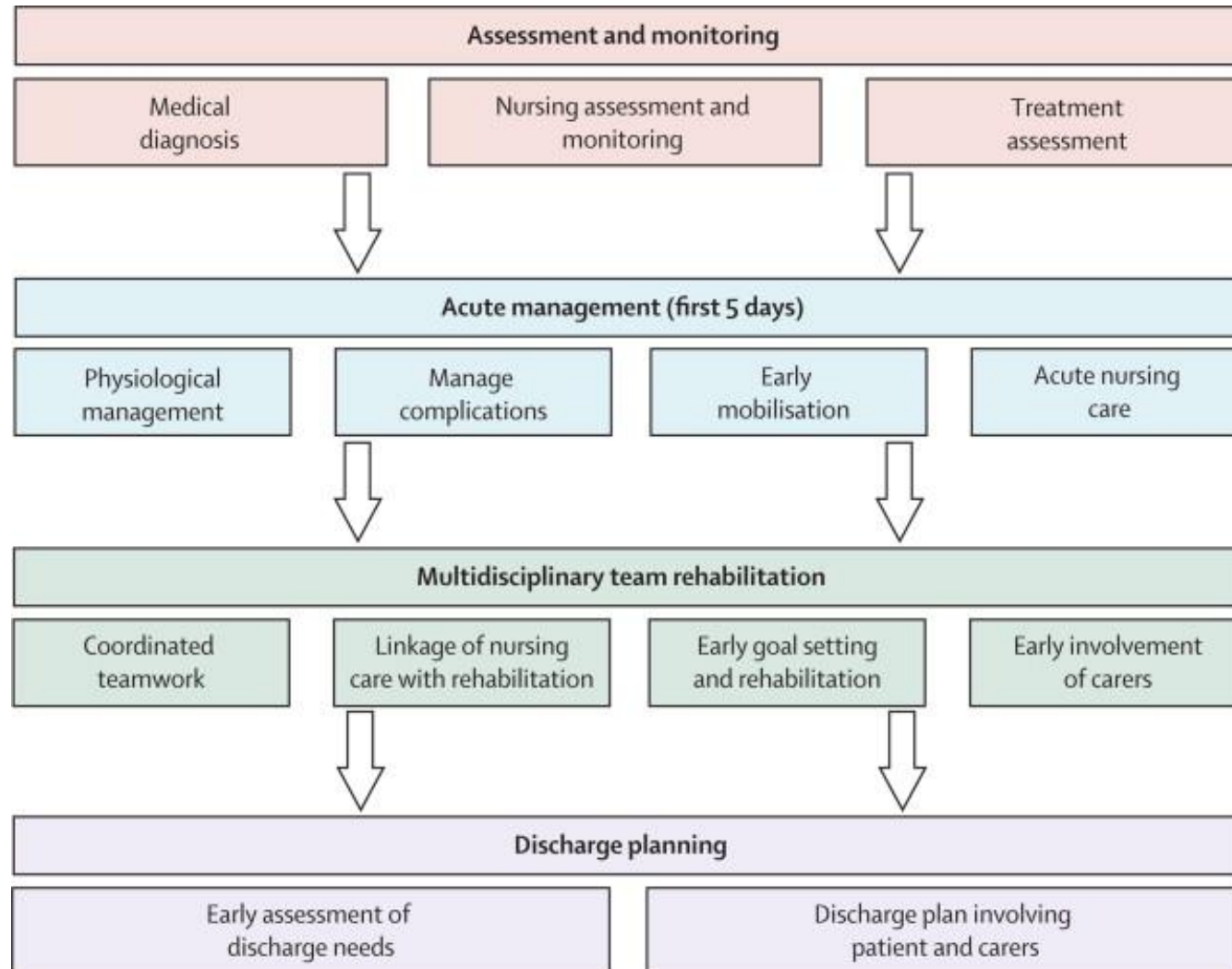
- Save lives
- Reduce dependency and institutionalisation
- No longer stays, no increased costs
- Irrespective of age, gender and stroke severity
- Justify service reorganisation



STROKE UNITS ARE EFFECTIVE IN LOW-MIDDLE INCOME COUNTRIES



KEY COMPONENTS OF STROKE UNITS LOW-MIDDLE INCOME COUNTRIES



Considerations in low-resource settings

Skills and training

Staff skills in stroke and rehabilitation; regular education in stroke and rehabilitation

Access existing training resources (including online materials)

Multidisciplinary teamwork

Formal multidisciplinary team meetings once a week to discuss individual patient progress, agree treatment goals, and plan management*

Incorporate teamwork into ward-round routine

Close linking of nursing with other multidisciplinary team care

Staff training might be needed
Shared clinical records

Early rehabilitation and goal setting

Staff (and carer) training might be needed

Family involvement

Family (carers) are involved early in the rehabilitation process

Incorporate into ward-round routine

Family (carers) are provided with information about stroke causes, impairments, rehabilitation, recovery, and prevention

Access existing training resources (including online materials)

Discharge planning

Early assessment of discharge needs; identification of recovery goals with patient and carer

Staff (and carer) training might be needed

Discharge plan involving patient and carers

Carer training important

Rehabilitation input in home setting

Carer training important
Consider telephone follow-up

Data taken from Stroke Unit Trialists' Collaboration⁴⁹ and World Stroke Academy. *Some units use regular meetings of the core multidisciplinary team comprising nursing, medical, and physiotherapy staff.

Table 2: Key multidisciplinary skills, training, and communication activities

STAFFING OF STROKE UNITS

LOW-MIDDLE INCOME COUNTRIES

	Staff complement (WTE) in the stroke-unit trials	Considerations in low-resource settings where staffing levels might be few
Nursing (all grades)	10	Supplement with training and involvement of family or carers in daily patient care
Medical (all grades)	1-2	Protocols of care to guide nursing staff and junior medical staff (under supervision)
Physiotherapy (all grades)	1-2	Supplement with training and involvement of family or carers in daily patient care
Occupational therapy	1	Protocols of care to allow roles to be adopted by other staff (eg, nursing, physiotherapy staff)
Speech and language therapy	0.5	Protocols of care to allow roles to be adopted by other staff (eg, nursing, physiotherapy staff)
Social work	0.5	Protocols of care to allow roles to be adopted by other staff (eg, nursing, physiotherapy staff)

Total staff complement in WTE for a stroke unit with **ten** beds. Staff complements represent (in WTE) all staff available (both on-duty and off-duty) per ten beds in the stroke unit. Data from Stroke Unit Trialists' Collaboration⁴⁹ and World Stroke Academy. WTE=whole-time equivalent.

Table 3: Indicative staffing levels

TREATMENT OF ACUTE STROKE

CASE 1 – SU –day 1

- Statin, continue
- Aspirin, withhold for 24 h
- Anti-hypertensives, stopped
- Swallowing testing deferred because of nausea
- Glycemia under control
 - Insulin 6-12 UI depending on blood glucose (>200 mg/dl)

TREATMENT OF ACUTE STROKE

CASE 1 –SU – day 2

- Fever & R pulmonary infection
 - Paracetamol
 - Antibiotics
- Deep venous thrombosis of the R lower limb
 - R/ LMWH

TREATMENT OF ACUTE STROKE

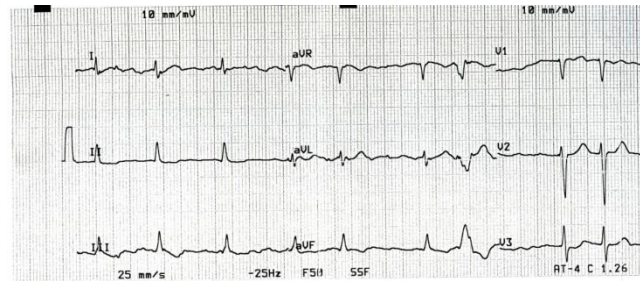
CASE 2 – Clinical course in the SU

- Vomited (3x)
- Swallowing test
 - Dysphagia
 - Nothing per mouth (0-24 h)
 - Nasogastric tube (> 24h)
- Fever & R pulmonary infection
 - Paracetamol
 - Antibiotics
- Sa O₂ <93%
 - O₂

TREATMENT OF ACUTE STROKE

CASE 2 – Clinical course in the SU

- Atrial fibrillation with high response rate (~ 120 p/m)
 - Amiodarone + bisoprolol



- High blood pressure
 - Bisoprolol; + Captopril



MONITORING PHYSIOLOGICAL & NEUROLOGICAL PARAMETERS

- Neurological status
- Cardiac rate & rythm/ ECG
- Dysphagia
- Blood pressure
- Temperature
- Sa O2
- Fluid balance
- Coagulation
- Glycemia

PREVENTING COMPLICATIONS

Clean hands and early mobilization

- Pneumonia
- Urinary infection
- Deep venous thrombosis
- Pulmonary embolism
- Cardiac complications
-
- Delirium
- Falls
- Decubitus ulcers
- Painful shoulder
- Dehydration
- Malnutrition

PREVENTING COMPLICATIONS

FALLS

- Assess the risk of falls



PRESSURE ULCERS

- Assess risk
- Early mobilization
- Frequent change in position



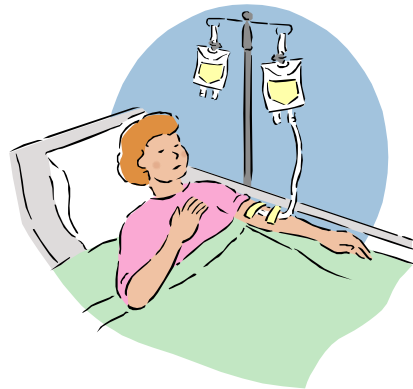
TREATING COMPLICATIONS

- Low/ high blood pressure
- Hypo / hyperglycemia
- Fever
- Fluid & electrolytes imbalance
- Pain, headache
- Nausea / vomiting
- Respiratory distress
- Seizures



TREATMENT OF ACUTE STROKE HYDRATION

- Acute stroke patients are often dehydrated
- Higher risk
 - Severe strokes
 - Disturbed consciousness
 - Vomiting
 - Dysphagia
 - Fever
- IV fluids
 - saline (0,9%) for 24 h
 - > 24h
 - Medical and Neurological status
 - Fluid balance and electrolytes



TREATMENT OF ACUTE STROKE NUTRITION

- Test for dysphagia
- If dysphagic, early nasogastric tube and feeding
 - Reduces mortality
- Early nasogastric tube better than early percutaneous gastrostomy
- No routine oral dietary supplements

TREATMENT OF ACUTE STROKE

Glycemia

- Hyperglycemia
 - Larger infarct size
 - Poor clinical outcome
 - Higher mortality
- Hyperglycemia in acute stroke
 - Known diabetic
 - Newly diagnosed diabetic
 - Stress hyperglycemia

Treatment

- Intermittent monitoring of capillary glycemia
- Treat
 - hyperglycemia >180 mg/dl
 - hypoglycemia <50 mg/dl
- IV fluids without glucose 24h
- Shift diabetic patients to sc insulin temporarily



TREATMENT OF ACUTE STROKE

Blood Pressure management

- Treat if
 - BP >220-120 mmHg
 - BP >185-110 mmHg, if treated with rtPA
 - Cardiac failure, aortic dissection, acute renal failure, encephalopathy
- As a rule, withhold pre-stroke anti-hypertensive drugs for a few days

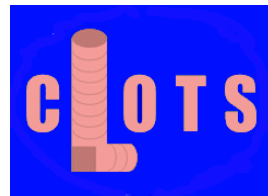


TREATMENT OF ACUTE STROKE DEEP VENOUS THROMBOSIS & PULMONARY EMBOLISM

- % DVT in hemiplegic patients
 - Clinical diagnosis ~ 1-16%
 - Doppler ~ 10%
 - MR Venography ~ 45%
 - Isotopes ~50%
- Higher risk
 - Immobilization
 - Obesity
 - Diabetes
 - Previous stroke
- Pulmonary embolism is a cause of death in acute stroke

TREATMENT OF ACUTE STROKE DEEP VENOUS THROMBOSIS & PULMONARY EMBOLISM

- Early mobilization
- LMWH, prophylactic dosages (I-A)
- Intermittent pneumatic compression
- *Graduated compression stockings*
 - > DVT with below-knee than thigh-length
 - Tight-length
 - No reduction of DVT
 - More skin complications



INTERMITTENT PNEUMATIC COMPRESSION TO PREVENT DVT

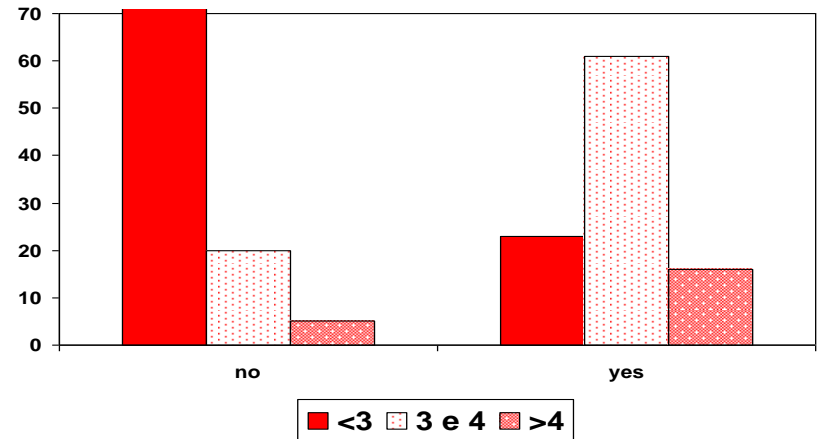
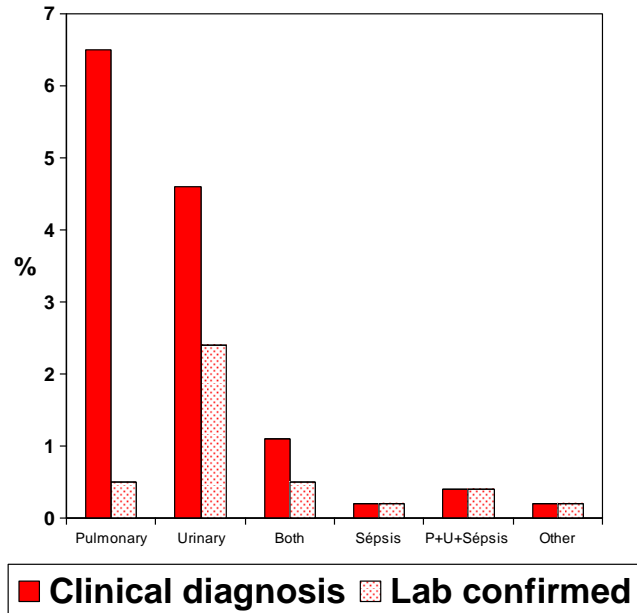


How nice

How costly?

TREATMENT OF INFECTIONS

SU reduce the risk of death after stroke through the prevention and treatment of complications, in particular infections*



Clean hospital and clean hands

Safe feeding

Avoid urinary catheter

Early mobilisation

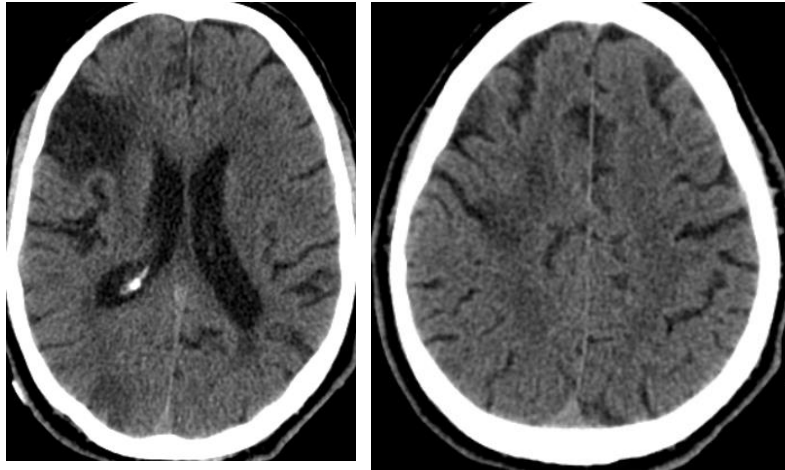
SEIZURES

- No indication for prophylactic AEDs
- Acute symptomatic seizures
 - Risk of worsening of neurological deficits
 - Risk of epileptic status
 - Check for co-morbid conditions
 - FB; PTH, CBZ or VPA
- Epileptic status
 1. Diazepam, lorazepam or midazolam IV
 2. PTH, VPA or LEV IV; FB IV
 3. Barbiturate or propofol IV, mechanical ventilation, ICU

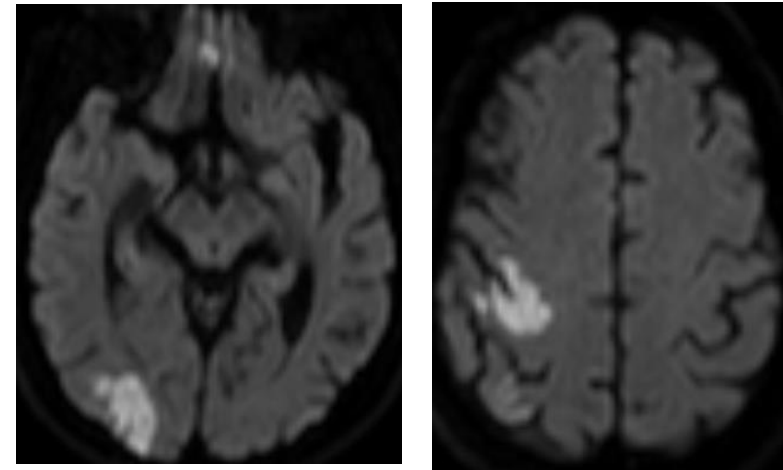
TREATMENT OF ACUTE STROKE

Case 1 – repeated imaging?

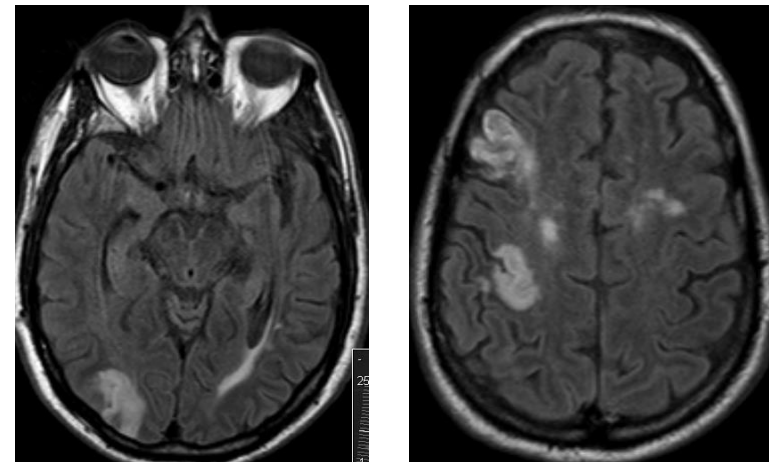
CT 48h



MR DWI



MR FLAIR

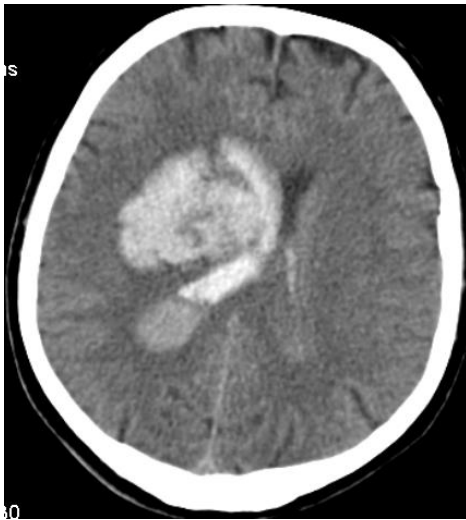


Repeated CT
MR DWI
MR FLAIR

TREATMENT OF ACUTE STROKE

CASE 2 – Neurosurgery?

- Neurological worsening (2nd day)
 - GCS 7-11



- Mannitol

- 3rd day



- Neurosurgical consultation

DECOMPRESSIVE SURGERY

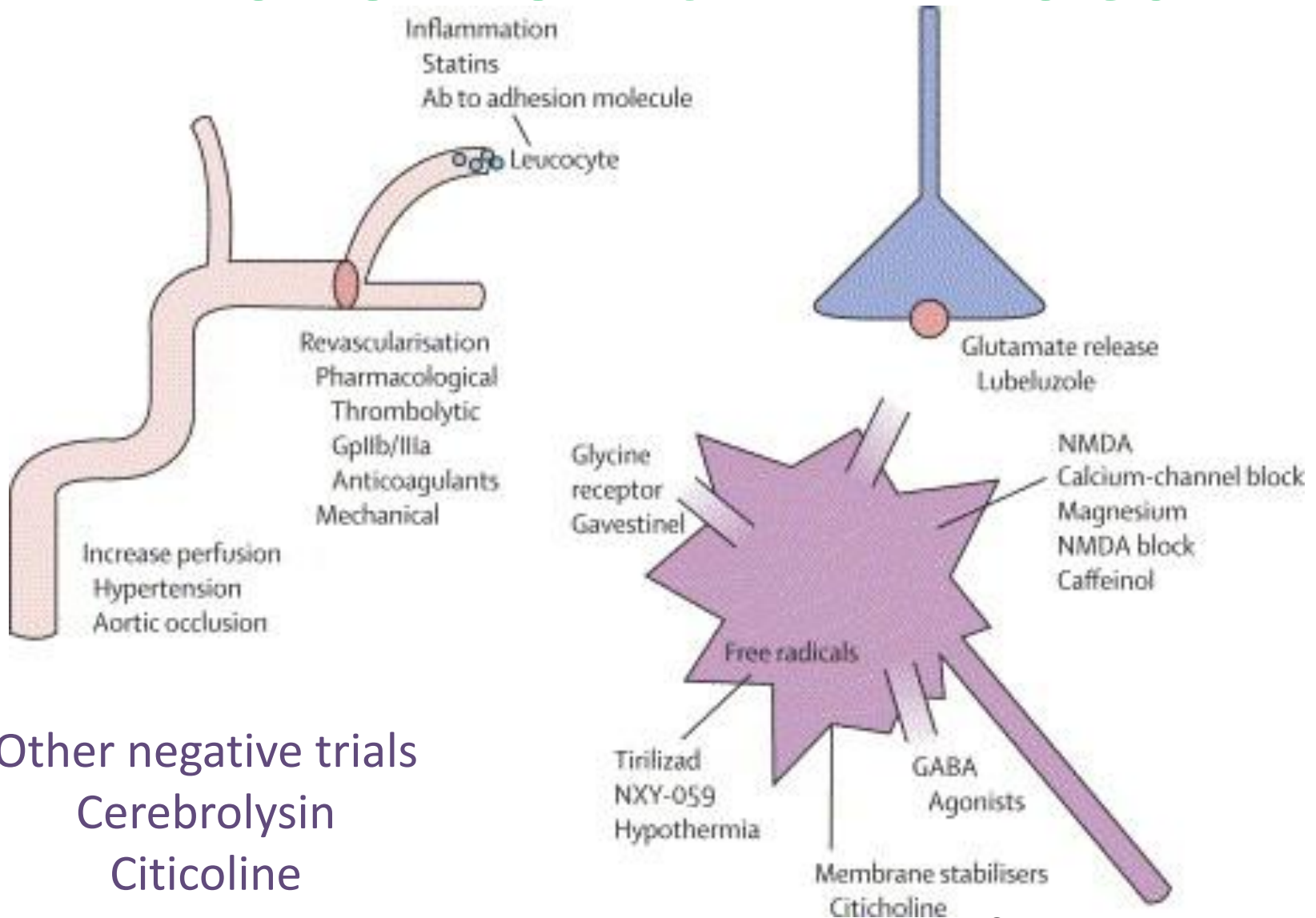
Saves lives

- Early <72h surgery prevents death and improves functional outcome
- Applies for R and L hemispheric strokes
- Applies for patients irrespective of age
- Posterior fossa decompression in large space-occupying cerebellar infarcts



Female, 27, TACI, dissection

DO NOT PRESCRIBE NEUROPROTECTIVE DRUGS



Other negative trials
Cerebrolysin
Citicholine

TREATMENT OF ACUTE STROKE

CASE 1 – an happy end

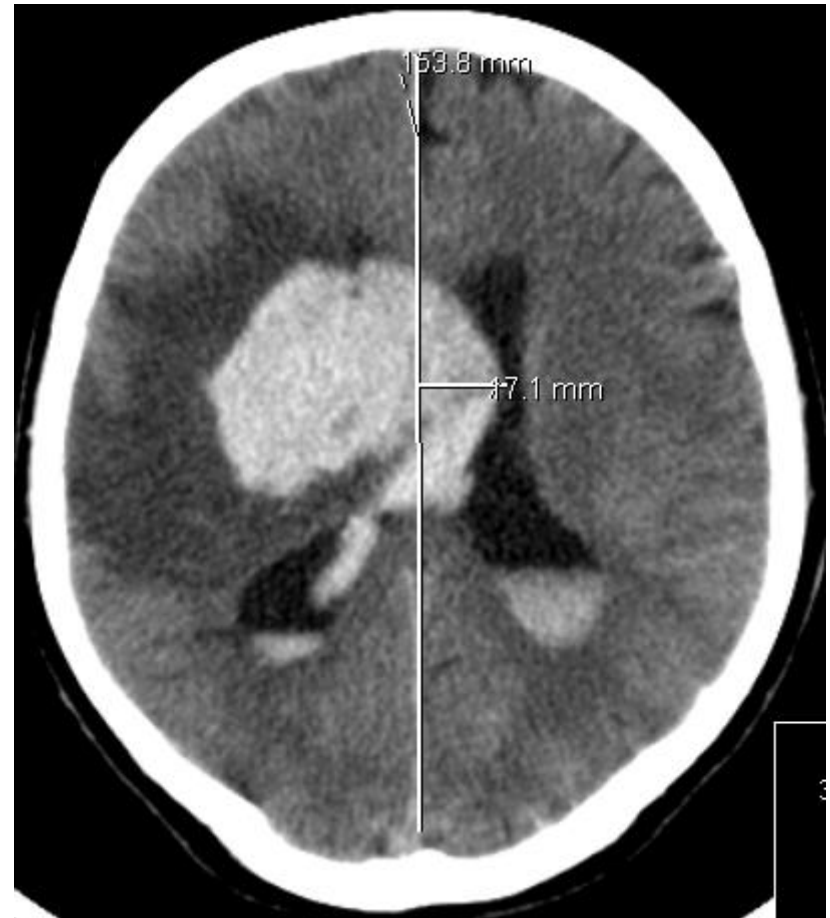
- Normal duplex and TCD
- Dilated L atrium
- No AF detected during continuous monitoring or Holter
- Atorvastatin
- Aspirin
- Continued LMWH
- Started rehabilitation
- Discharged to local hospital on the 7th day
- NIHSS – 3
- mRS – 2
- TOAST – unknown cause
- Repeat Holter: pAF
 - Oral anticoagulant

TREATMENT OF ACUTE STROKE

CASE 2 – a peaceful end

Clinical course in the Stroke Unit

- Day 3 – GCS -3
- Prognosis discussed with family
- Palliative care
- Transferred to home country



TREATMENT OF ACUTE STROKE

QUALITY INDICATORS

ERS (PT)/Joint Commission

- CT
- rtPA if <4.5 h, no contraindications
- Dysphagia testing
- DVT prophylaxis
- Secondary prevention
 - Antiplatelet, statin
 - Anticoagulant if AF
 - Endarterectomy if indicated
- Physiotherapy

ESO

- CT (< 1 h)
- Admission to Stroke Unit
- rtPA if indicated (< 60 m)
- Dysphagia testing
- Secondary prevention
 - Antiplatelet
 - Statin
 - Anti-hypertensives
 - Anticoagulant if AF
 - Endarterectomy, if indicated
- Vascular imaging

ACUTE STROKE CARE

Scenario 1 – minimum health care services

- Rural community with a visiting health worker
 - Limited access to physicians
 - Variable access to health workers
 - No access to diagnostic tests or hospital care
 - Variable access to medication
 - Access to internet
- Prevention of complications
 - Fever, infections, pneumonia, DVT, skin ulcer
 - Avoid indwelling catheters
 - Assess swallowing
 - Assess hydration and nutritional status
- Early (>24h) mobilization
- Prevention of recurrent stroke
 - Aspirin, anti-hypertensive drugs
- Palliative care for devastating strokes
- Family involvement and training
 - Positioning and mobilization
 - Feeding
 - Stroke prevention



ACUTE STROKE CARE

Scenario 2 – minimum health care services

- Community with health clinic
 - Limited access to physicians
 - Variable access to health workers
 - Limited access to diagnostic tests or hospital care
 - Variable access to medication
 - Access to internet
- Prevention of complications
 - Fever, infections, pneumonia, DVT, skin ulcer
 - Avoid indwelling catheters
 - Assess swallowing
 - Assess hydration and nutritional status
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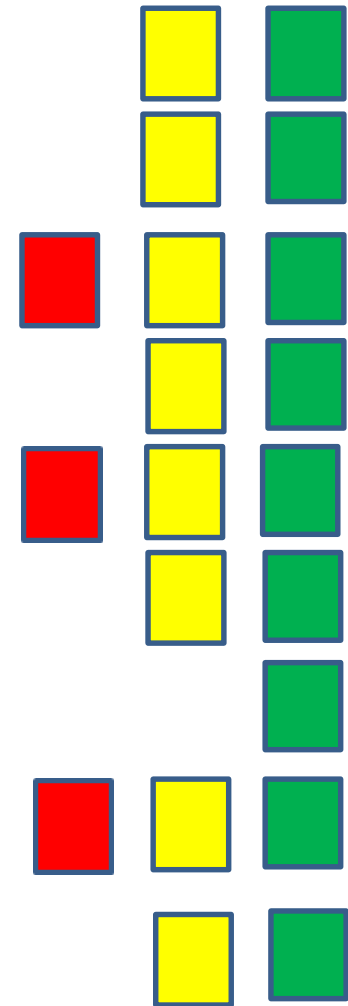
	Independent evidence of benefit	Considerations in low-resource settings
Fluid and food management		
Careful management of fluids and food (intravenous saline in the first 12–24 h; early nasogastric tube feeding if swallowing is unsafe)	Indirect evidence from stroke-unit trials only	Needs access to basic monitoring facilities
Monitoring and management of physiological abnormalities		
Hypoxia	Might improve early neurological recovery ⁵⁹	Needs access to oxygen and oxygen monitor
Blood pressure	Acute reduction not usually needed	Based on simple clinical observations (antihypertensive intervention rarely needed)
Pyrexia (and infection)	Paracetamol might improve outcome if pyrexia related ^{60,61}	Based on simple clinical observations and basic drug treatments Use acute-care protocol ⁶²
Hyperglycaemia (>10 mmol/L)	Part of effective acute-care protocol ⁶² Intensive glucose control not needed ⁶³	Needs blood glucose measurements and insulin Use acute-care protocol ⁶²
Swallowing management		
Identification and management of impaired swallowing	Dysphagia management reduces complications ⁶³ Part of effective acute-care protocol ⁶²	Needs staff (and carer) training Use acute-care protocol ⁶²
Early mobilisation		
Careful positioning and handling	Basic protocol for positioning reduces chest infections ⁶⁴	Needs staff (and possibly carer) training Basic protocol might be useful ⁶⁴
Able to sit, stand, and walk as soon as possible	Might improve recovery ^{65,66}	Needs staff (and possibly carer) training
Nursing care		
Pressure-area care	Indirect evidence from stroke-unit trials only	Needs staff (and possibly carer) training; staffing levels are important
Continence management (avoid catheters if possible)	..	Needs access to equipment

Key components of early stroke management. Data from Stroke Unit Trialists' Collaboration⁴⁹ and World Stroke Academy.

Table 1: Basic care in a stroke unit

PREHOSPITAL & EMERGENCY CARE IN 3 DIFFERENT SCENARIOS

- Transportation to hospital
- Urgent CT
- Blood analysis
- ECG
- Evaluation by a MD trained in stroke
- Eligibility for IV rtPA (<4.5h)
- Eligibility for thrombectomy (<6h)
- Aspirin
- Hospital admission



ACUTE STROKE CARE

Scenario 3 to 4 – essential to advanced stroke services

- Large urban hospital upgrading stroke services
- Should be able to provide
 - Thrombectomy
 - Neurosurgery
 - Intensive care
 - Comprehensive diagnostic evaluation



REGIONAL & NATIONAL TOOLS

- Stroke awareness campaigns (prevention, recognition and reaction)
- National emergency telephone number
- Patient transportation and transfer system
- Access to internet

REGIONAL & NATIONAL TOOLS

- Hospital SOPs for stroke patients
- Stroke Units
- Stroke patient coordinated referral system
- Guidelines for stroke prevention and care
- Hospital SOPs for stroke patients
- Indicators and assessment (self and external)

Greetings from Lisbon Academical Medical Center Stroke Unit

