EAN Regional Teaching Course

ISCHEMIC STROKE

State of the art in diagnostic work-up and therapeutic management

José M Ferro
Department of Neurosciences and Mental Health
Hospital de Santa Maria- CHLN
University of Lisboa
Portugal

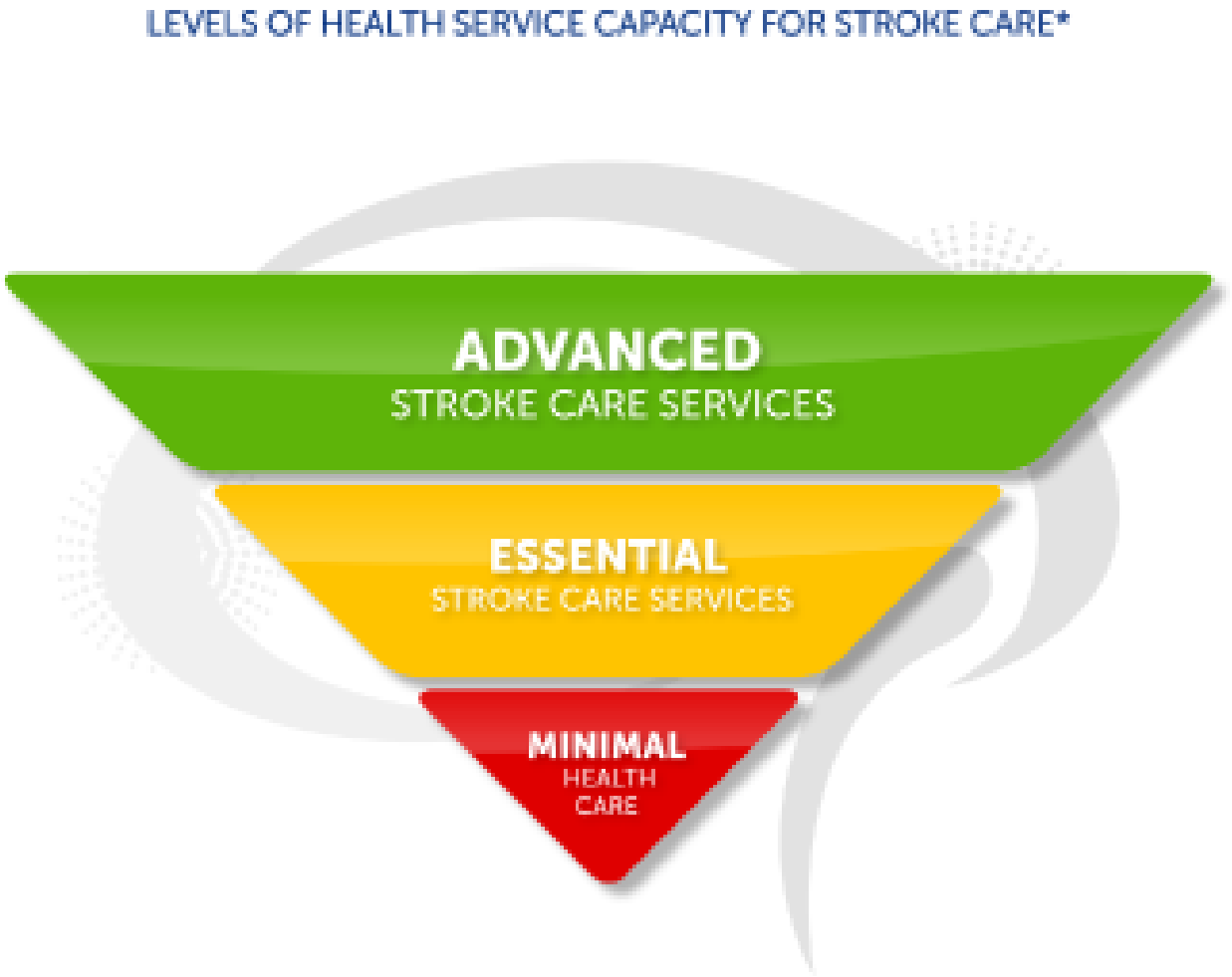
Stroke is preventable and treatable!

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

GLOBAL STROKE ACTION PLAN FRAMEWORK

International Journal of Stroke 2014

World Stroke Organization Global Stroke Services Guidelines and Action Plan



International Journal of Stroke
4-13, 23 SEP 2014

World Stroke Organization Global Stroke Services Guidelines and Action Plan

Health services capacity for stroke care checklist

Advanced stroke services	Essential stroke services	Minimal healthcare 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	❑ 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	❑ 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.

CASE 1

Recognition and reaction to stroke symptoms

- 77 year old male, with hypertension diabetes
- On aspirin, statin, amlodipine+valsartan, carvedilol
- 18:00 - Sudden onset of left hemiparesis, facial assymetry and speech disturbance
- Wife called 112 at 18:05

CASE 1 – rapid transportation of the stroke victim

- Ambulance arrived at 18:25
- Paramedics evaluation
  - Left hemiparesis and dysartria
  - BP 143-100 mmHg, pulse 63 regular, blood glucose 109 mg/dl
- Paramedics called Santa Maria Hospital (HSM) Stroke Pathway “Via verde” mobile
- Ambulance left to HSM at 19:03
- Patient arrived at HSM Emergency at 19:53

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

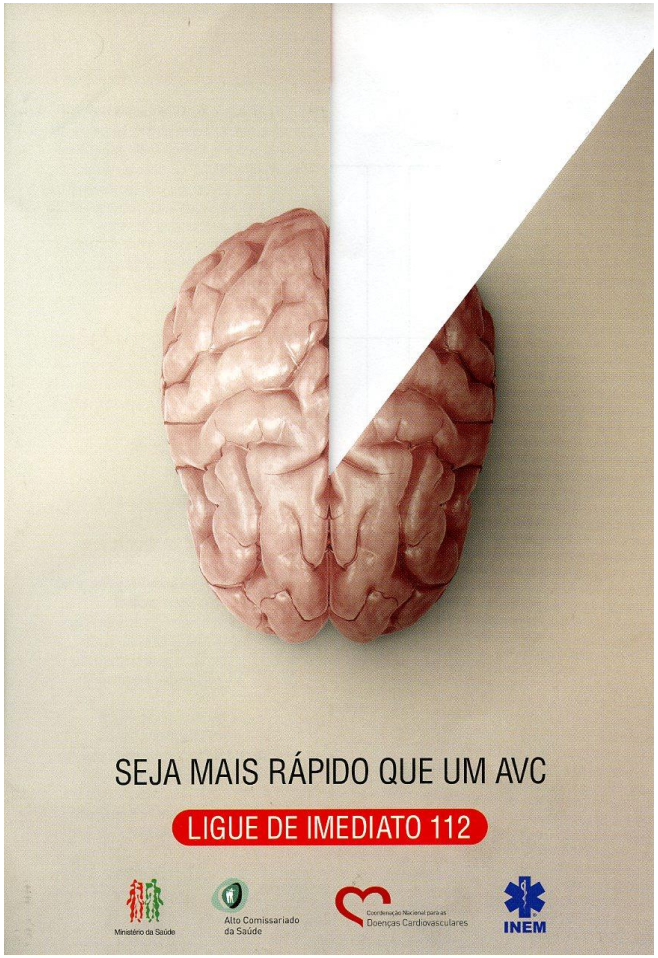
STROKE PATHWAY
"VIA VERDE PARA O AVC"

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

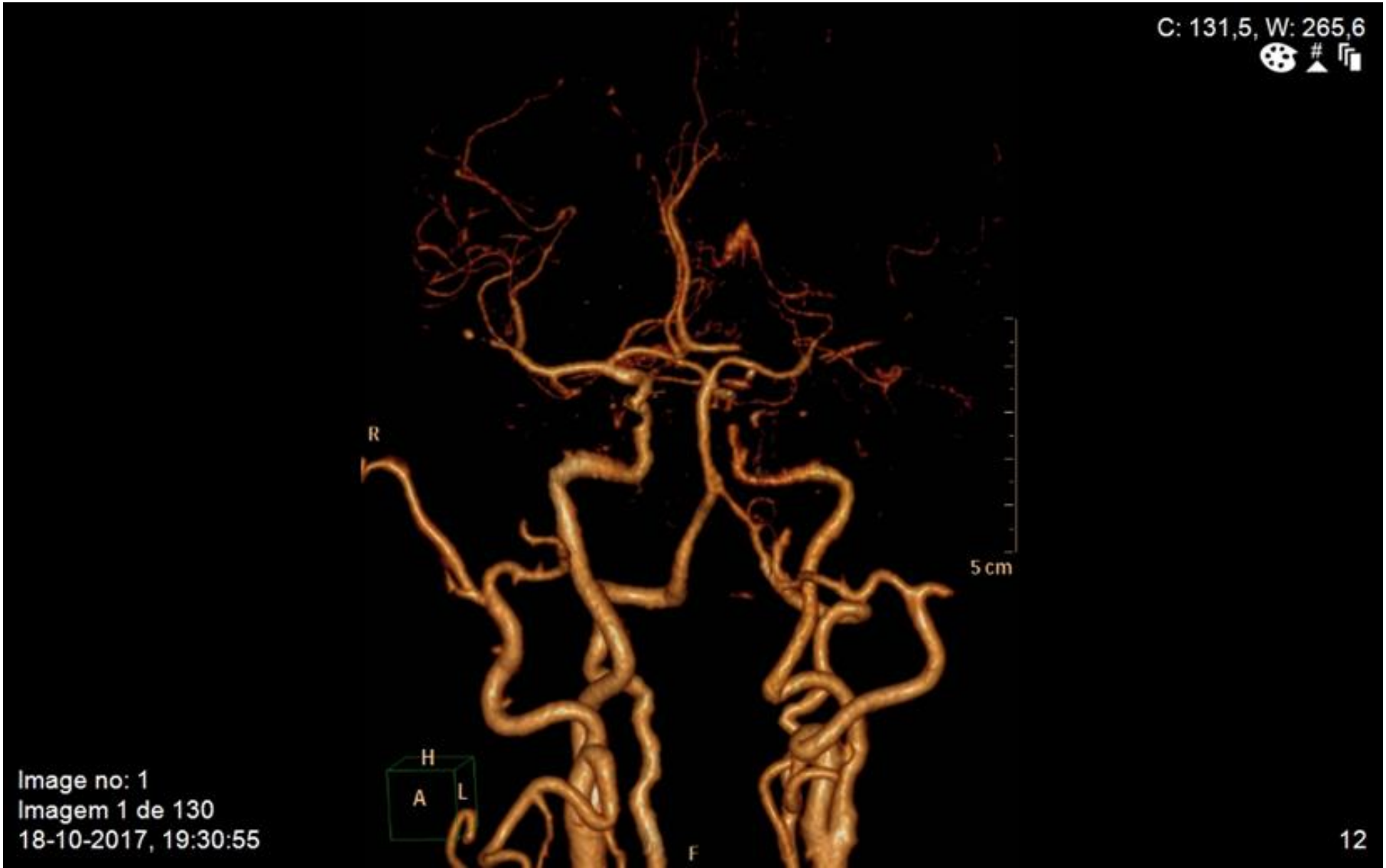
Go the nearby health centre that can provide stroke care



CASE 1- Ischemic stroke? Candidate for IV thrombolysis? For thrombectomy?

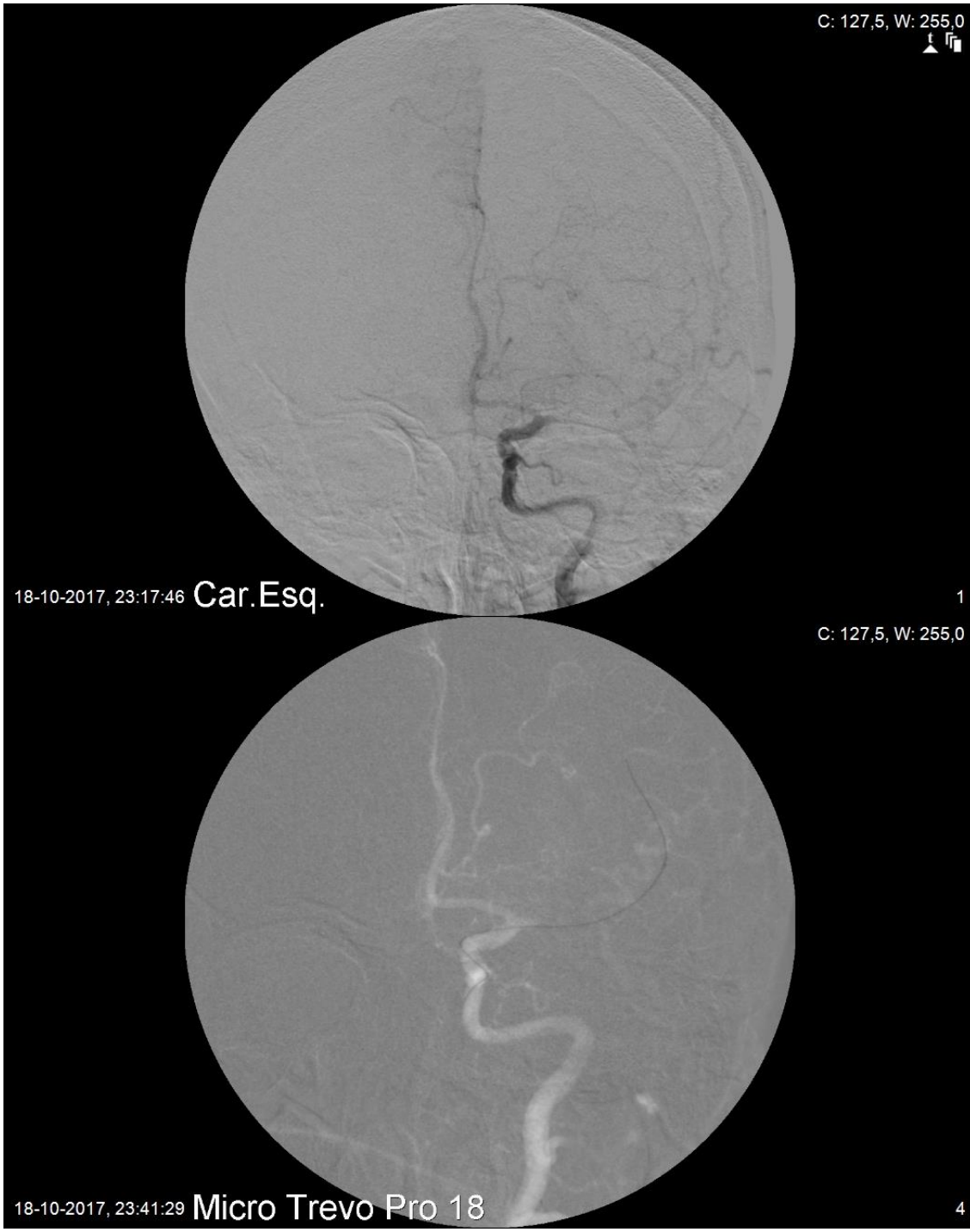
- Neurologist on duty
  - NIHSS – 15 worsened to 22
  - BP 142/87
  - CT – no early infarct signs
    - ASPECTS 10
  - CT angio –M1 left MCA occlusion
  - ECG – LVH
  - No contraindications for rtPA
  - Started rtPA bolus at 21:10 (180m)
  - Finished perfusion at 22:20
  - NIHSS - 20

CASE 1- Ischemic stroke? Candidate for IV thrombolysis? For thrombectomy?

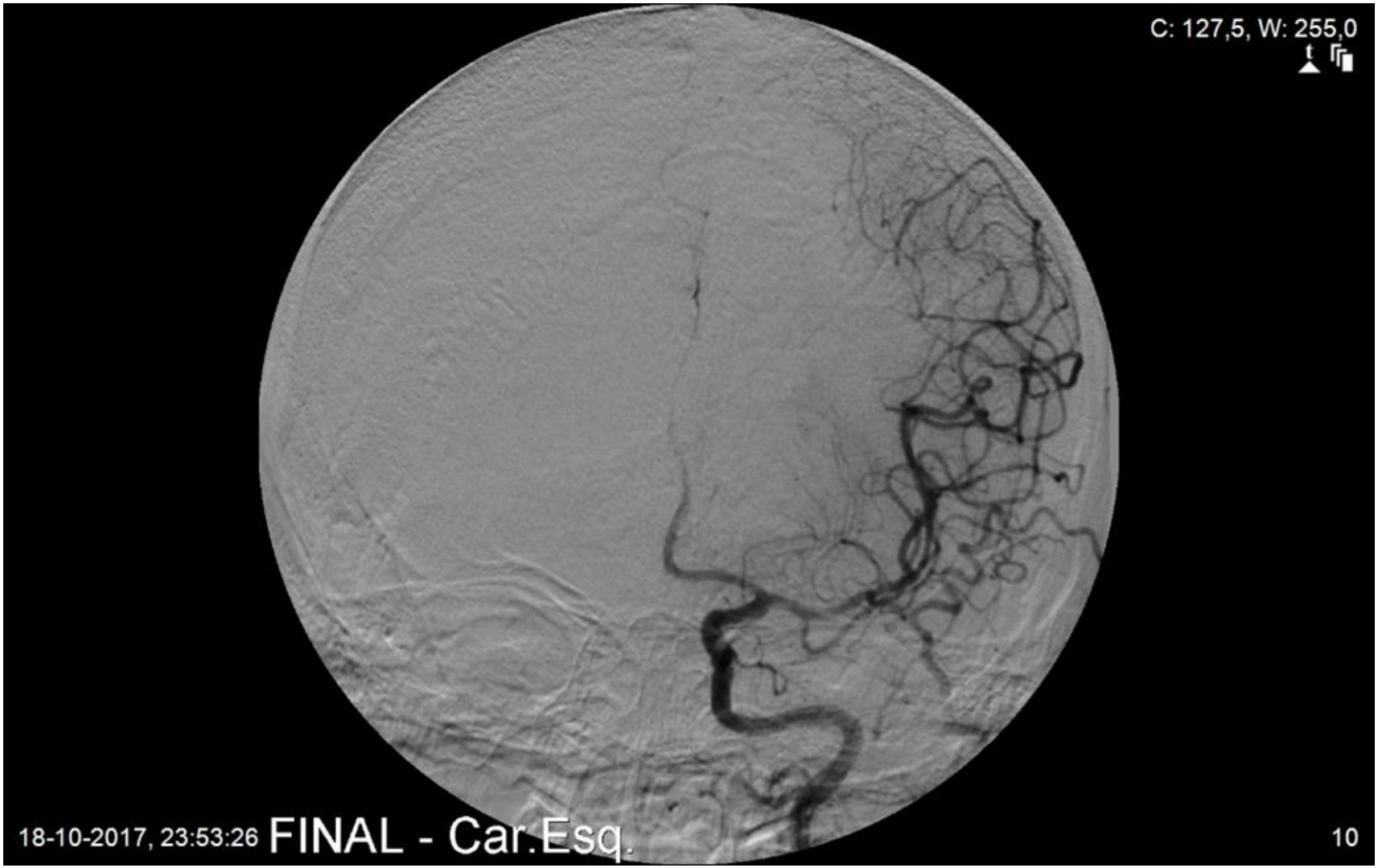


- Mechanical thrombectomy started at 23.10

- Trevo microcatheter & trevo stent single pass



CASE 1- Successful thrombectomy



TICI – 3

NIHSS - 5

CASE 1- Successful thrombectomy

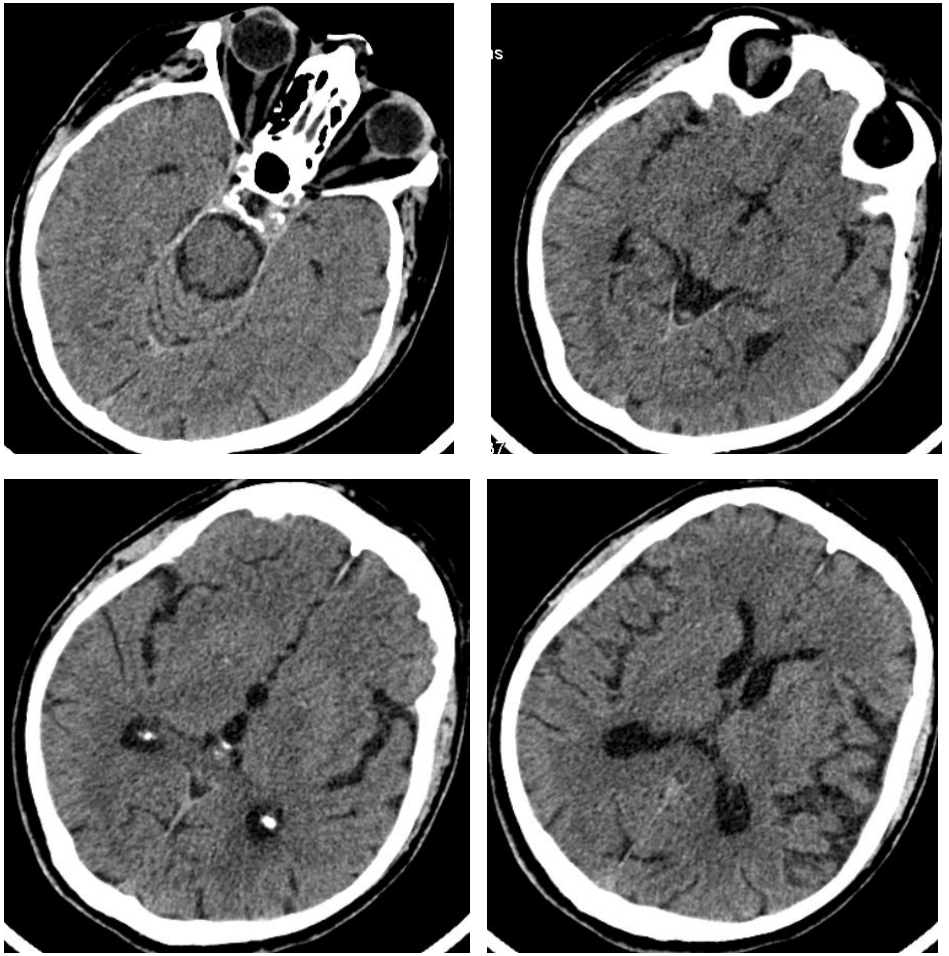
- No aphasia
- Mild right upper limb paresis and minimal lower limb weakness
- NIHSS - 4

CASE 2

Ischemic stroke?

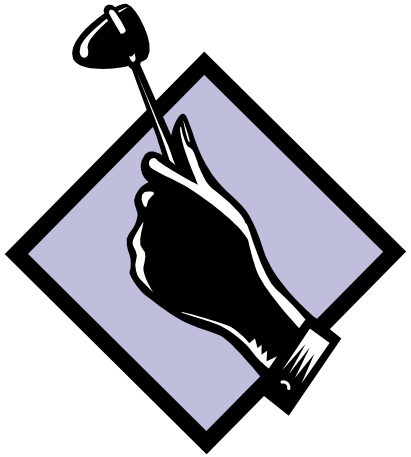
Candidate for thrombolysis/thrombectomy?

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



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, basilar
  - NIHSS > 5, ASPECTS >5

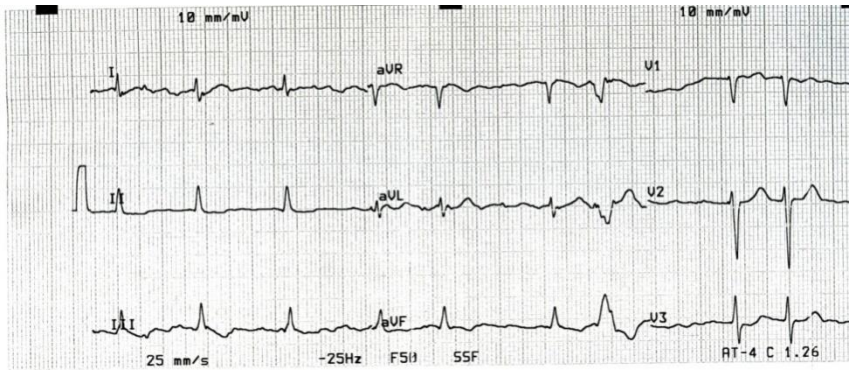


Stroke mimics

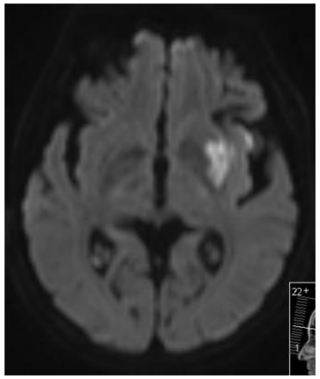
- Somatoform disorders
- Focal vascular seizures
- Migraine with aura
- Peripheral vertigo
- Peripheral facial palsy
- Brain tumor
- Subdural hematoma

Hyperacute evaluation

- Blood sample (<20 m)
  - blood cell count, platelets, INR, aPPT, glucose
- ECG

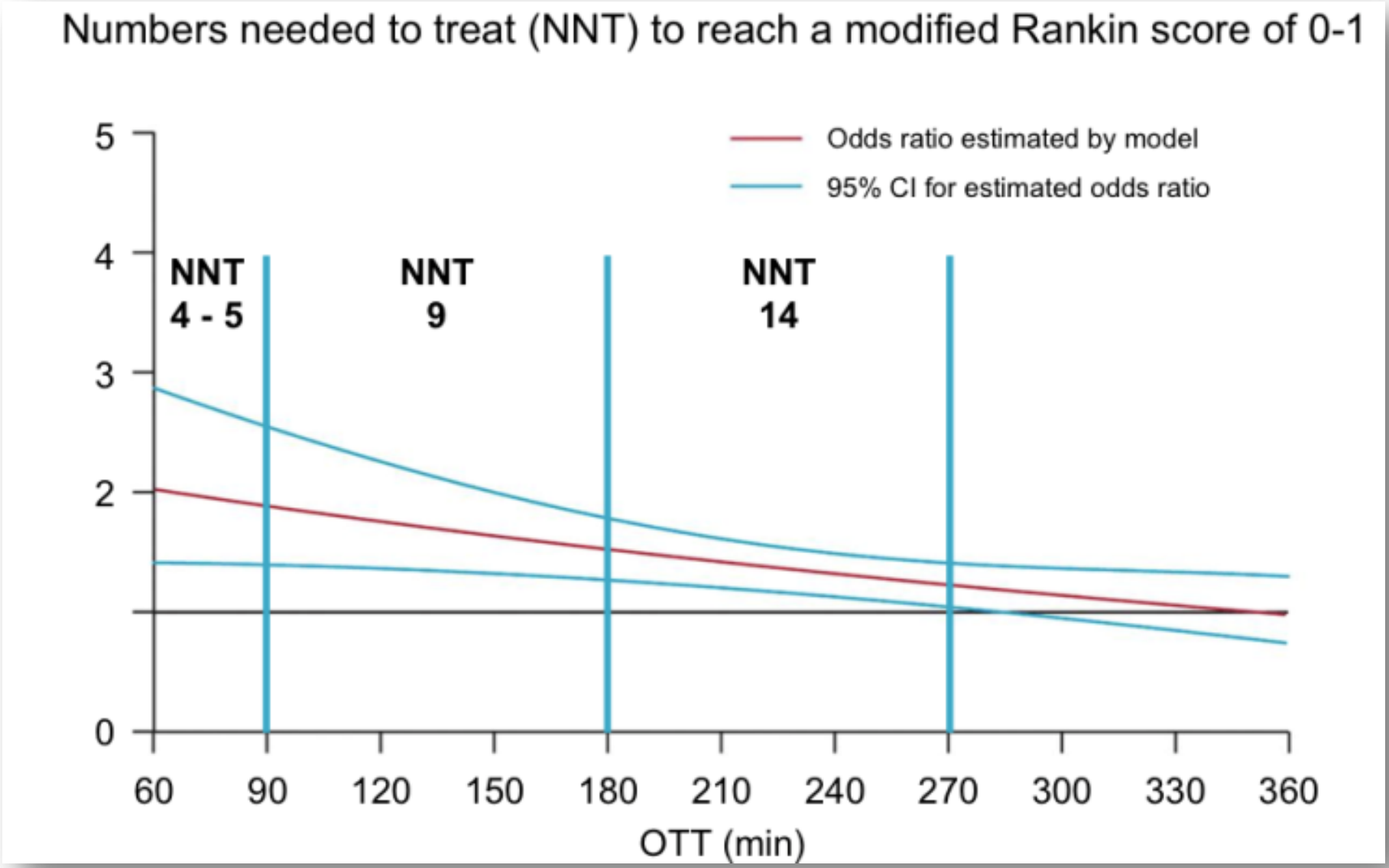


- Brain CT (results <45m)
- CT Angiography (if thrombectomy available)



- MR (to confirm diagnosis and extent, to assess mismatch)

"Time is brain"



Thrombolysis or thrombectomy?

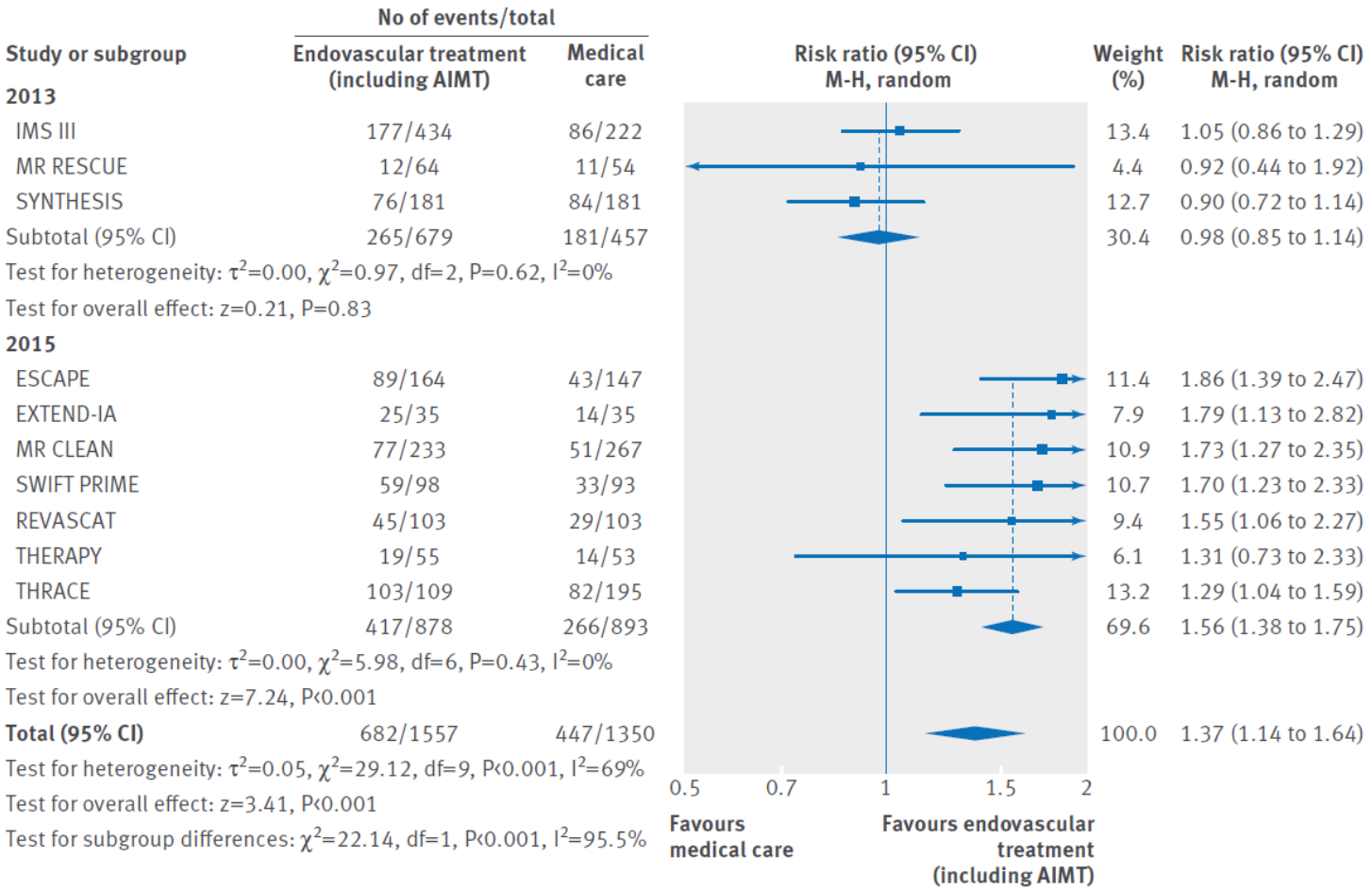


Fig 3 | Forest plot for a good functional outcome (modified Rankin scale core ≤2) at 90 days, including subgroup analysis by year of study publication. AIMT=adjunctive intra-arterial mechanical thrombectomy

Rodrigues FB et al, BMJ, 2016

No longer matter of debate

- rtPA standard (0.9 mg/Kg) or lower (0.6 mg/Kg) dosage?
  - Similar death/dependency rates; less ICH (ENCHANTED trial – mainly Asians)
- Thrombectomy: aspiration or stent retriever?
  - Aspiration not better (ASTER trial)
- Thrombectomy: conscious sedation or general anestesia?
  - General anesthesia preferable

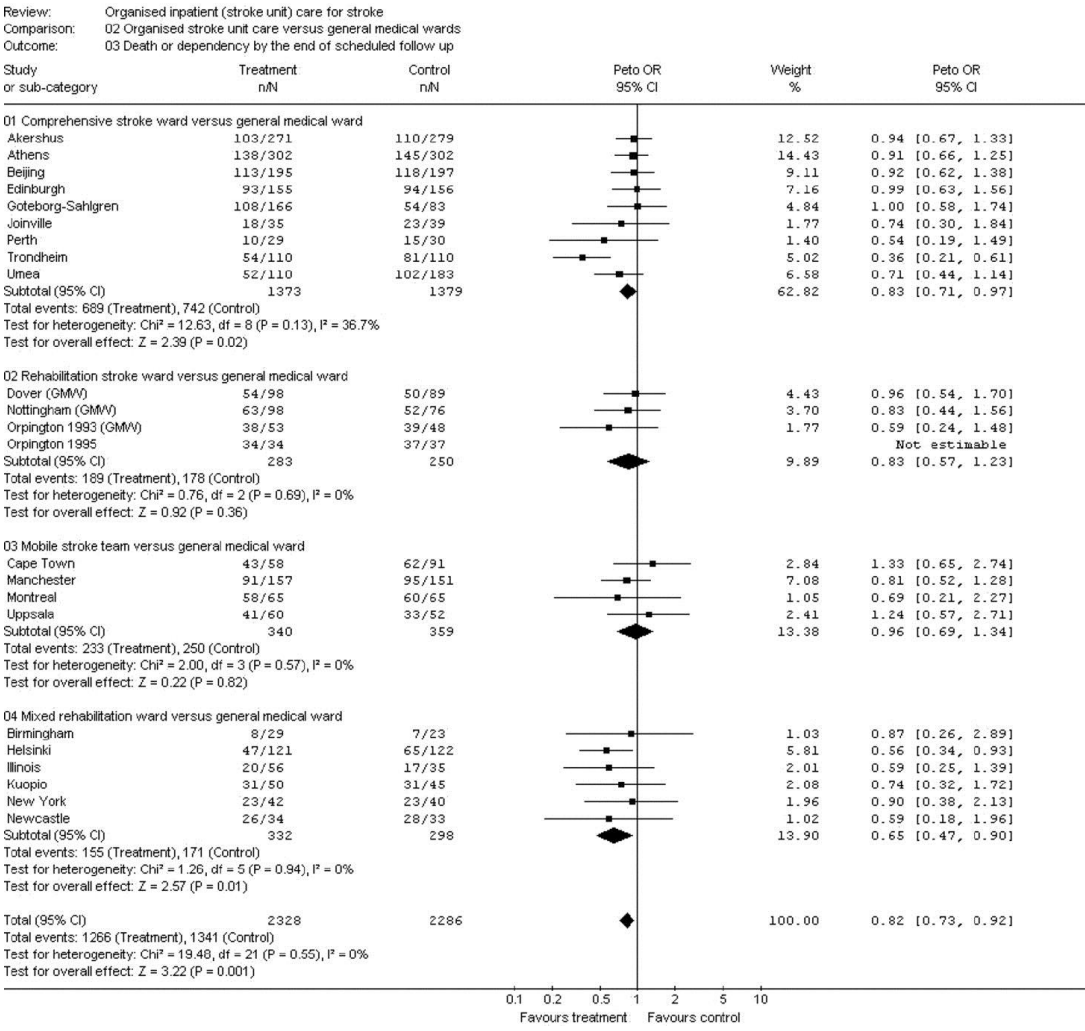
Anderson CS et al N Engl J Med 2016; Lapergue B et al JAMA 2017; Schonenberger S et al JAMA 2016

Management 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 ADMITED? TO STROKE UNITS!

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



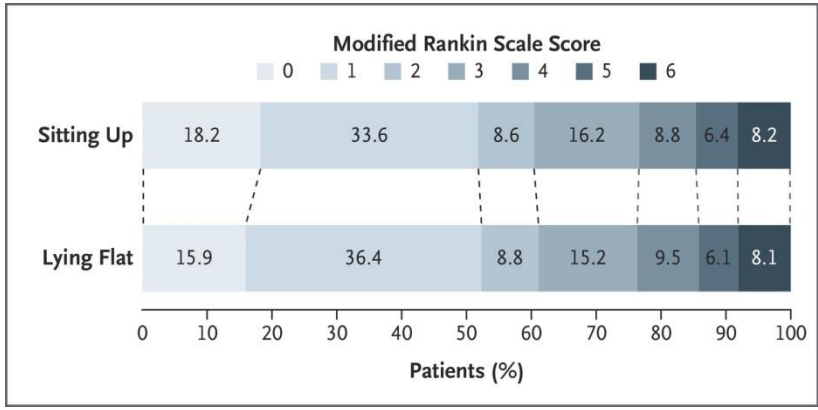
Govan L et al. Stroke 2008;39:2402-2403

CASE 1 – Stroke Unit – day 1

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

POSITION IN BED

- HeadPoST RCT
- Lying flat vs. Head > 30º
- 11,093 patients with acute stroke



C.S. Anderson et al, N Engl J Med, 2017

CASE 1 – Stroke Unit – day 2

- Fever, high PCR
- Clinical & Rx signs of pulmonary infection
  - Paracetamol
  - Antibiotics (amoxiciline + clavulanate) for 7 days

- Prevention of deep venous thrombosis of the lower limbs
  - R/ LMWH, prophylactic dosage

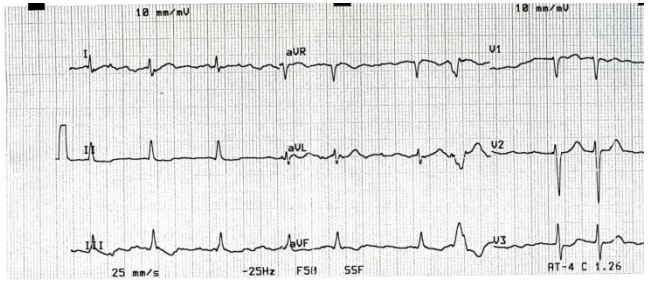
CASE 2 – Clinical course in the SU

- Vomited (3x)
- Swallowing test
  - Dysphagia
  - Nothing per mouth (0-24 h)
  - Nasogastric tube (> 24h)

- Fever & R pulmonary infection
  - Paracetamol
  - Antibiotics
- Sa O2 <93%
  - O2

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

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

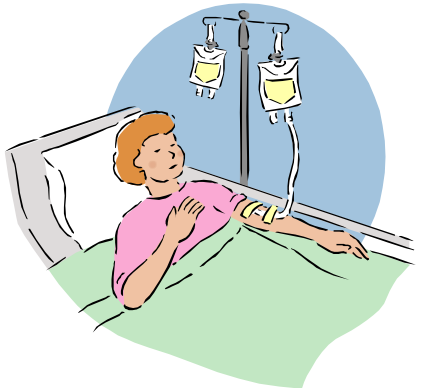
- Assess risk
- Early mobilization
- Frequent change in position

TREATING COMPLICATIONS

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

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

NUTRITION

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

Glycemia

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

Treatment

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

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

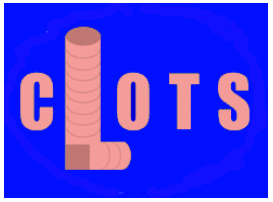
DEEP VENOUS THROMBOSIS PULMONARY EMBOLISM

- % 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

DEEP VENOUS THROMBOSIS
PULMONARY EMBOLISM

- Early mobilization
- LMWH, prophylactic dosages (I-A)
- Intermittent pneumatic compression

- *Graduated compression stockings*
  - > DVT with below-knee than thigh-lenght
  - Tight-lenght
    - No reduction of DVT
    - More skin complications

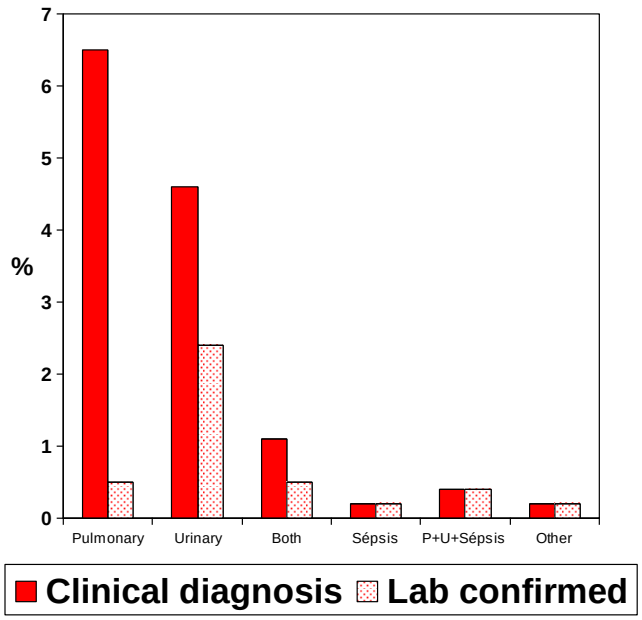


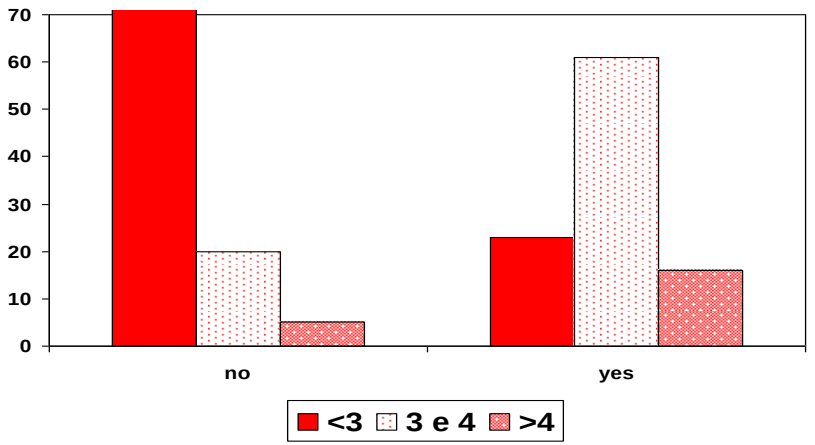
CLOTS, Dennis et al 2009, 2010, 2015

INTERMITENT PNEUMATIC COMPRESSION TO PREVENT DVT

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, VPA or LEV
- Epileptic status
  1. Diazepam, lorazepam or midazolan IV
  2. PTH, VPA or LEV IV; FB IV
  3. Barbiturate or propofol IV, mechanical ventilation, ICU

CASE 2 – Neurosurgery?

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

- Mannitol

- 3rd day

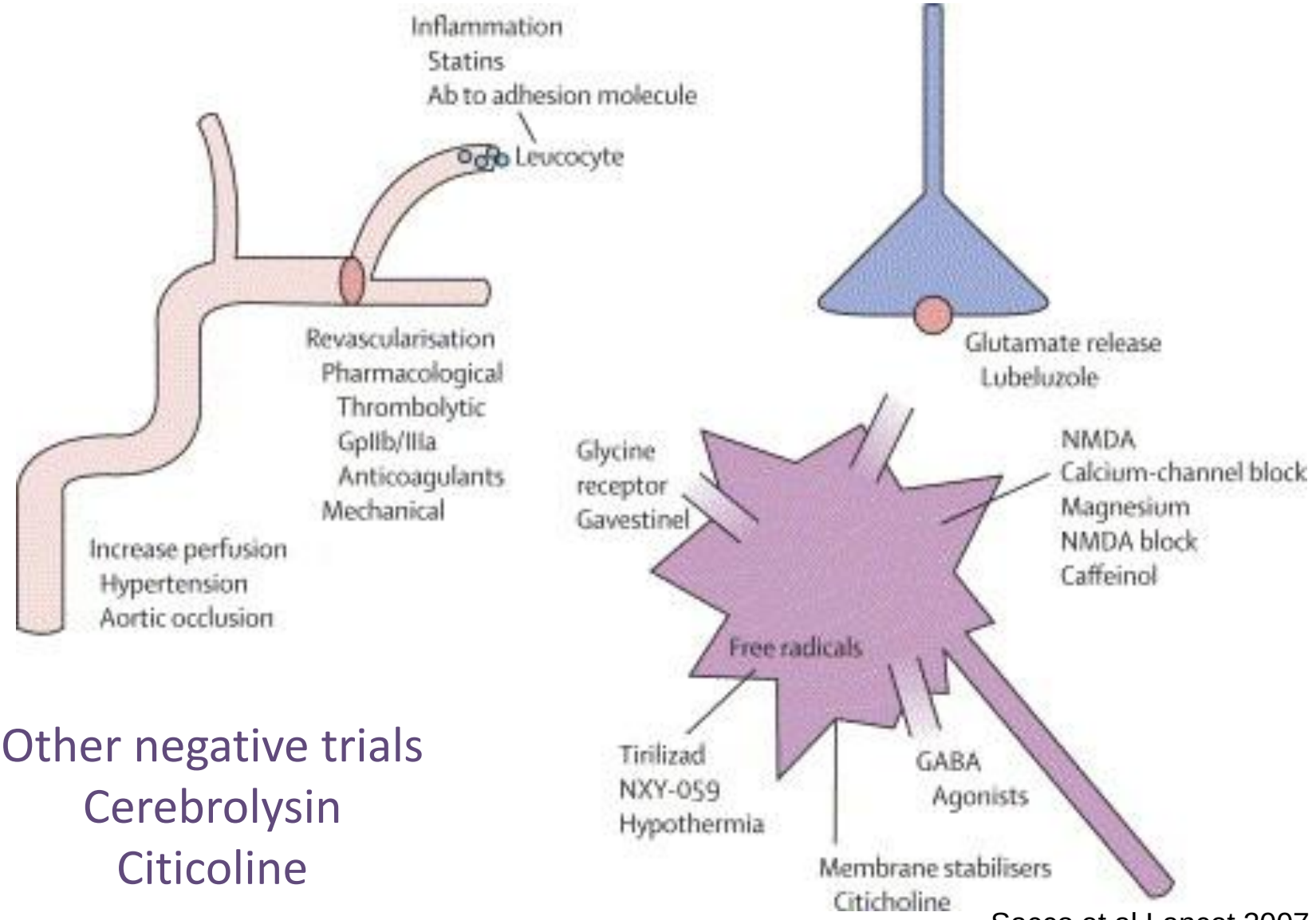
- Neurosurgical consultation

DECOMPRESSIVE SURGERY
Saves lifes

- 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
Citicoline

Sacco et al Lancet 2007

CASE 1 – searching for the cause

- Large vessel disease?

- Carotid & vertebral ultrasound
  - Left – 50% carotid stenosis, heterogeneous, partly calcified
  - Right – 40% carotid stenosis, heterogeneous, partly calcified

CASE 1 – searching for the cause

- Cardioembolism?

- TT Echocardiogram
  - Dilated L atrium; left ventricular hypertrophy

- Holter
  - At 2:19 pAF for 4:43 (70-163 bpm)

CASE 1 – secondary prevention

- Continue statin
- Continue antihypertensives
- NOAC (Edoxaban 60 mg id)

CASE 1 – good recovery

- Started rehabilitation

- Discharged to local hospital on the 7th day
- NIHSS – 3
- mRS – 4
- TOAST – cardioembolic

CASE 2 – a peaceful end

Clinical course in the Stroke Unit

- Day 3 – GCS -3
- Prognosis discussed with family
- Paliative care
- Transfered to home country

FOLLOW UP VISIT

1. Are the patient & family following life style advices?
2. Is the patient taking medications for secondary prevention regularly?
3. Is the patient doing any rehabilitation, if needed?
4. Was the cause of stroke identified? Were all recommended investigations performed?

- If response is no, find why, discuss solutions and act

COMPLICATIONS DURING FOLLOW UP

- Depression
- Anxiety, stress disorder, personality changes
- Fatigue
- Sleep problems
- Musculoskeletal pain
- Dysphagia
- Constipation
- Urinary and sexual problems
- Spasticity
- Central pain
- Epilepsy
- Cognitive impairment
- Stroke recurrence
- Other new vascular events
- Other diseases and hospital admissions

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

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
- Indicators and assessment (self and external)

Greetings from
Lisbon Academical Medical Center Stroke Unit