



# *How we built our program in Kraków*

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- „National Programme for the Equalization of Accessibility for the Prevention and Treatment of Cardio-Vascular Diseases” POLKARD 2010-2012, financed by the Ministry of Health:  
"The purchase of medical equipment for Stroke Units providing treatment of stroke in the acute phase with use of endovascular methods"
- This program was carried out together by the Stroke and Radiology Departments at the University Hospital in Krakow.
- Purchase 5 Solitaire stents, in the course of the program used

**3 stents !!**

**Endovascular treatment of ischemic stroke**  
**Neurology, 2012 American Academy of Neurology**  
Issue: Volume 79, Supplement 1 pgs. S1-S255 September  
25, 2012

**Organizational Structure of Stroke Centers in USA –  
recommendations of Brain Attack Coalition**  
Recommendations for Comprehensive Stroke Centers. A  
consensus statement from Brain Attack Coalition. Alberts  
MJ *et al.* *Stroke* 2005

# Stroke

JOURNAL OF THE AMERICAN HEART ASSOCIATION



## **Formation and Function of Acute Stroke–Ready Hospitals Within a Stroke System of Care Recommendations From the Brain Attack Coalition**

Mark J. Alberts, Lawrence R. Wechsler, Mary E. Lee Jensen, Richard E. Latchaw, Todd J. Crocco, Mary G. George, James Baranski, Robert R. Bass, Robert L. Ruff, Judy Huang, Barbara Mancini, Tammy Gregory, Daryl Gress, Marian Emr, Margo Warren and Michael D. Walker

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## **Requirements:**

- **Medical staff specialized :**
  - neurology and cerebrovascular diseases 24/7
  - neurosurgery 24/7
  - endovascular therapy of vascular diseases of the brain – IR radiology 24/7
  - vascular surgery - endarterectomy
  - diagnostic imaging of vascular diseases of the brain
  - ultrasound diagnosis of intracranial arteries
  - Echocardiographic diagnosis
  - Anesthesiology and Intensive Care
  - rehabilitation (movement/physical and speech)
  - Highly specialized nursing care of patients with stroke and patients with dysphagia
- **Access to brain imaging techniques (CT, angio CT, pCT, MR with diffusion, angio-MR, DSA, doppler transcranial, carotid artery ultrasound, transthoracic echocardiography and transesophageal)**

- **Ability to perform following neurosurgery and endovascular procedurs:**
  - **Surgical treatment of aneurysms**
  - **Surgical removal of the brain hematoma**
  - **Brain drain**
  - **Endovascular treatment of aneurysm and hemangiomas**
  - **Neurovascular thrombectomy**
  - **endarterectomy**
- **Infrastructure: Stroke Department, Intensive Care, Operating Room, Interventional Radiology Center, Stroke Registry**
- **Educational and research programs**



GUIDELINES

## Standards of practice in interventional neuroradiology

Olav Jansen<sup>1,4</sup> · Istvan Szikora<sup>2</sup> · Francesco Causin<sup>1</sup> · Hartmut Brückmann<sup>3</sup> ·  
Kyriakos Lobotesis<sup>3</sup>

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**Abstract** The growing importance of INR has resulted in the need to define and promote professional standards of clinical practice. Several professional organizations have published guidelines recently for the neurointerventional treatment of cerebrovascular diseases, including technical and personal recommendations, but detailed definitions of technical and organizational conditions needed for the safe and effective performance of such treatments are lacking. To fill this gap ESNR, ESMINT and the UEMS Division for Neuroradiology established a working group, to develop a consensus paper on “Standards of Practice in Interventional Neuroradiology”. This document is the result of the Consensus Working Group and has following review gained approval by the Executive Boards of ESNR and ESMINT and by the members of the UEMS Division for Neuroradiology in 2017.

**Keywords** Interventional neuroradiology guideline

of patients with ischemic and haemorrhagic stroke. Subsequently, with the plethora of clinical evidence demonstrating a significant improvement in patient outcomes, INR has evolved from a niche field to a major element in the management of cerebrovascular diseases in everyday practice.

This growing importance of INR has resulted in the need to define and promote professional standards of clinical practice. The role of these standards is to guide and assist with the development of safe staffing practices, appropriate delegation of tasks to personnel, as well as the overall management of the INR team and healthcare organization infrastructure. The scientific acceptance of endovascular therapy is rooted in studies that were primarily performed in established INR departments implementing evidence-based standards [1–6].

INR is a highly specialized discipline which necessitates combining manual dexterity and skill with a high level of scientific and clinical knowledge of neuroradiology and neurosciences. Evidence shows that INR treatment provides the



ESNR European Society of Neuroradiology  
Diagnostic and Interventional



European Union of Medical Specialists  
Section Radiology | Division Neuroradiology

## Stroke Center



### Interventional neuroradiology techniques include:

- **Embolization**
- **Angioplasty**
- **Devices implantation (stents, coils, etc.)**
- **Thrombectomy**
- **Percutaneous spinal/head and neck procedures**
- **Image-guided administration of drugs**



# Stroke Center

## Site conditions

- ✓ **Inpatient hospital wards/beds**
- ✓ **A suitable interventional angiography suite(s), which is part of a Radiology/Neuroradiology/ Neurointerventional Dpt**
- ✓ **A team of trained NIR / neurointerventionists which is part of a Radiology/ Neuroradiology/Neuro-Interventional Dpt**
- ✓ **A dedicated and comprehensive Diagnostic Neuroradiology Dpt /Section that comprises state-of-the-art CT and MR facilities**
- ✓ **A Dept. of Neurosurgery and Neurology Dept. with neurovascular expertise**
- ✓ **Intensive Care Unit**

# University Center of Interventional Therapy of Acute Brain Stroke (CITO) – January 2013 - still

## Goal

*Implementing new methods of treating cerebral ischemic stroke based on the endovascular treatment*

## The area of the standard operations

*Kraków and surroundings (+/- 120 km)*

## Population covered by the project

*2 200 000 people (average 2100 ischemic cerebral stroke/year)*

# **University Center of Interventional Therapy of Acute Brain Stroke (CITO)**

## **Organization Structure:**

- **Stroke Unit of Neurology Departments**
- **Interv. Radiology Lab of Diagnostic Imaging Departments**

## **Support Units:**

- **Krakow Emergency Medical Service**
- **Hospital Emergency Department**
- **Neurosurgery Department**
- **Vascular Surgery Department**
- **Intensive Care Unit**

# Emergency Medical Service – „emergency card stroke”

## KARTA KWALIFIKACJI DO LECZENIA PRZYCZYNOWEGO UDARU NIEDOKRWIENNEGO MÓZGU PRZEZ ZESPÓŁ RATOWNICTWA MEDYCZNEGO

Imię i nazwisko: .....

PESEL: ..... Data badania: ..... Godzina badania: .....

Telefon do rodziny/opiekuna: .....

Czy chory doznał udaru mózgu? \*

Czy była utrata przytomności/omdlenie?

TAK (-1) - ☐ NIE (0) - ☐

Czy były drgawki?

TAK (-1) - ☐ NIE (0) - ☐

Czy następujące objawy pojawiły się nagle lub zostały stwierdzone po obudzeniu?

Asymetria twarzy

TAK (+1) - ☐ NIE (0) - ☐

Jednostronne osłabienie kończyny górnej

TAK (+1) - ☐ NIE (0) - ☐

Jednostronne osłabienie kończyny dolnej

TAK (+1) - ☐ NIE (0) - ☐

Zaburzenia mowy

TAK (+1) - ☐ NIE (0) - ☐

Niedowidzenie

TAK (+1) - ☐ NIE (0) - ☐

RAZEM:  (-2 do +5)

(\*udar mózgu, gdy liczba punktów  $\geq 0$ )

Wstępna diagnoza:

udar mózgu - ☐

inna choroba - ☐ (.....)

### Ważna informacja

Czas zachorowania: (data) .....; (godzina) .....; (minuta) .....

*(Jeśli chory znaleziony z objawami udaru rano lub po śnie to należy wpisać godzinę, kiedy ostatni raz chory był widziany zdrowy)*

Chorego należy przetransportować do najbliższego SOR-u gdy:

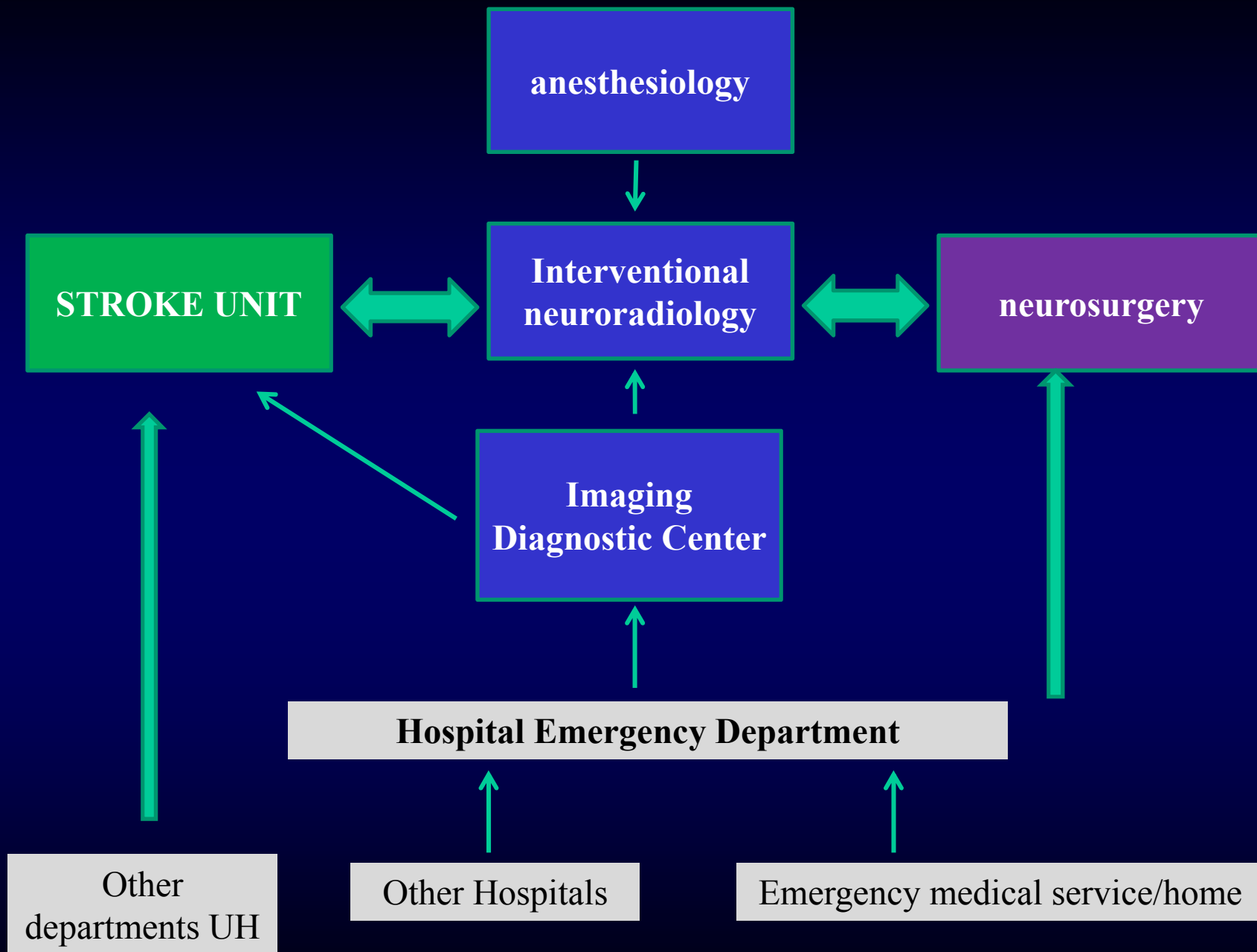
- czas od zachorowania do zdiagnozowania przez Kierownika Zespołu Ratownictwa Medycznego wynosi  $< 3.5$  godziny
- czas od zachorowania do zdiagnozowania przez Kierownika Zespołu Ratownictwa Medycznego wynosi  $> 8$  godzin

Chorego należy przetransportować do SOR-u SU gdy:

- czas od zachorowania do zdiagnozowania przez Kierownika Zespołu Ratownictwa Medycznego wynosi od 3.5 do 8 godzin po telefonicznym porozumieniu z lekarzem dyżurnym neurologiem w:

..... tel. nr: .....

(data, podpis) .....



# University Center of Interventional Therapy of Acute Brain Stroke (CITO)

**Neurologists: 5 (Stroke Unit)**

**NIR team: 3** (NIR, NIR nurse,  
electroradiology technician)

**Anesthetic team: (anesthesiologist, a. nurse)**

**24h/7days**

**Data as at the end of January 2018:**

- **iv r-tPA: 112/y (  $\approx$  25% treated for stroke)**
- **150 MT (2013-2018)**  
**69 (66,3%) preceded by iv r-tPA**

# CITO – diagnostic protocol

Patients  $\leq 6$  h of the stroke onset

**CT w/o cm – ASPECT scale**

- **Angio-CT – intracranial + extracranial brain aa.**

*(from aorta arch)*

tortuosity, kinking, stenosis, abnormalities, **COLLATERALS !!!!!**

- **pCT,**

- **MR border line cases (wake up, posterior circulation)**



# CITO – results

## Patients:

- 42/150 (28%) ♀; av age  $65,2 \pm 14.5$ ; (22-89y)
  - ❖ 69% - home
  - ❖ 16% - other hospital in Kraków area
  - ❖ 15% - hospital from Malopolska region  
(longest distance from Kraków - 120 km)

## CITO – results

- **NIHSS on admission: 5-42 (mean: 15.7±5.3)**
- **Localisation of embolic material:**
  - ❖ **ICA - 28 (18.7%)**
  - ❖ **MCA M1 - 80 (53.3%)**
  - ❖ **MCA M2 – 19 (12.7%)**
  - ❖ **MCA M3 – 3 (2.0%)**
  - ❖ **Tandem occlusion - 15 (10%)**
  - ❖ **BA: 11 (7.3%)**

## CITO – results

- i.v r-tPA + MT - 107 pts (71.3%)
- MT - 43 pts (28.7%):
  - ❖ > 4.5 h - 15 (10.0%)
  - ❖ anticoagulants- 14 (9.3%)
  - ❖ others – 14 (9.3%)
- i.a r-tPA - 6 pts (4%)
- CAS – 10 pts (6.7%)
- Time from stroke onset – f.a.p  
*253±86 min. (+/- 93-450 min.)*

## CITO – results

- **mTICI (technical success):**

❖ 0 - 13 (8.7%)

❖ 1 - 12 (8.0%)

❖ 2a – 30 (20.0%)

❖ 2b – 24 (16.0%)

❖ 3 - 71 (47.3%)

**63.3 %**

## CITO – results

- mRs in 90d :



❖ 0	- 72 (68.0%)
❖ 1	- 6 (4.0%)
❖ 2	- 4 (2.7%)
❖ 3	- 10 (6.7%)
❖ 4	- 8 (5.3%)
❖ 5	- 15 (10.0%)
❖ 6	- 35 (23.3%)

74.7 %

## CITO – results

- **types of thrombectomies:**
  - ❖ **Solitaire - 100 (66.6%)**
  - ❖ **Penumbra - 5 (3.3%)**
  - ❖ **Aperio - 4 (2.7%)**
  - ❖ **Trevo - 20 (13.3%)**
  - ❖ **Eric - 1 (0.7%)**
  - ❖ **Preset - 3 (2.0%)**
  - ❖ **Solambra - 17 (11.3%)**

# Summary

- ❖ Team of NI + N + A
- ❖ TIME
- ❖ Dedicated N
- ❖ Protocol for ABC and PBC
- ❖ Emergency service



