Cerebrovascular diseases

- 2nd most often reason of death and the most often reason of disability,
- every year - 16.9 millions new strokes and a 5.9 millions of death
- Disability-Adjusted Life Years and Death in relations to strokes
- 1990 vs 2013
- From 3,54% to 4,62%
- From 9,66% to 11,75%,

Epidemiology

- **Incidence** – 125 – 446/100 000 inhabitants (Feigin V.L. et al., Lancet Neurol, 2009)

- **SLOVAKIA**
  - Mortality: 100-200/100 000
  - Incidence: 224/100 000
Cerebrovascular diseases

- Diseases with sudden onset, or rapid development of focal cerebral dysfunction as the consequence of lesion of cerebral arteries. There are 2 types:
  - Brain ischemia (stroke) or
  - Brain haemorrhage
Two Types of Stroke

Ischemic Stroke
- anoxia
- thrombus

Hemorrhagic Stroke
- hemorrhage
- a rupture of the vessel
Ischemic Stroke

- blood-deprived area

Hemorrhagic Stroke

- bleeding area

- blood flow is obstructed

- a ruptured blood vessel leaks blood into brain
Stroke

Haemorrhage
• Intracerebral
• Subarachnoid

85%

Ischemic

15%

Atherosclerotic

20%

Penetrating Arteries (lacunar)

25%

Cardiogenic embolic
• FP
• Valvular d.
• Atrial thrombus
• Others

20%

Cryptogenic

30%

Other rare diseases
• Protrombotic disease
• Dissection
• Arteritis
• Others

5%

Hypoperfusion

20%

AS embolic
Cerebrovascular diseases

Brain ischemia

Brain haemorrhage

Subarachnoid haemorrhage
Head injury, NO stroke

Subdural hematoma

Epidural hematoma
Anatomy of cerebral arteries
Vertebral arteries

Foramina transversaria
Regulation of cerebral circulation

- Blood flow - 50 – 60 ml/100 g of brain tissue/min.

- Blood flow below 20 ml/100 g/min.
  - functional changes of neurons – reversible dysfunction (few hours) – Penumbra (4,5 – 8 hours)

- Blood flow below 12, or 10 ml/100 g/min structural changes
  irreversible changes – brain infarct
Penumbra
MTT tp1 2:45 hours

MTT tp2 6:00 hours

Regions of Reperfusion

Prolonged MTT tp1

Prolonged MTT tp2

Absolute Reperfusion = Prolonged MTT tp1 – Prolonged MTT tp2

Relative Reperfusion = Absolute Reperfusion / Prolonged MTT tp1

doi:10.1161/STROKEAHA.110.600957.
Risk factors of stroke

Non modifying RF
- Age
- Sex
- Genetics

Modifying RF
- Hyperetension
- Atrial fibrillation
- Smoking
- Hypercholesterolemia
- Alcohol
- Asympt. stenosis ACI
- Diabetes mellitus

Sacco, Neurology 1998, 51 (Suppl 3), S27-S30
Nontreated arterial hypertension

A – at admission  B – hours after admission
Arterial hypertension

- The most severe risk factor for stroke
- Recommendation of „International Society on Hypertension“ – target values
  - 135/85 Torr in patients without organs damage,
  - 130/80 Torr in patients with organs damage, in correlation with AHA, ACC recommendations
- According „National Heart, Lung, and Blood Institute-appointed“ panel for older people recommendation is:
  - Target value –
  - < 150/90 mm Hg for patients > 60 years of age
  - < 140/90 mm Hg for younger patients

Atherosclerosis

- Risk of embolism, hypoperfusion

Secondary prevention

Optimal management of vascular risk factors

Recommendations

- It is recommended that blood pressure be checked regularly. Blood pressure lowering is recommended after the acute phase, including in patients with normal blood pressure (Class I, Level A).

- It is recommended that blood glucose should be checked regularly. It is recommended that diabetes should be managed with lifestyle modification and individualized pharmacological therapy (Class IV, GCP).

- In patients with type 2 diabetes who do not need insulin, treatment with pioglitazone is recommended after stroke (Class III, Level B).

- **Statin therapy is recommended in subjects with non-cardioembolic stroke (Class I, Level A).**

- It is recommended that cigarette smoking be discouraged (Class III, Level C).

- It is recommended that heavy use of alcohol be discouraged (Class IV, GCP).

- Regular physical activity is recommended (Class IV, GCP).
Fig 1: blockage in the carotid artery
Atrial fibrillation 5-times increased risk of stroke

AF depending on age

Feinberg W.M., Arch Intern Med 1995
Kardiálne ochorenia
Fibrilácia predsiení

- Warfarin vs Aspirin
  - redukcia RR – 39% *(ESC guidelines, Europace, 2010)*
  - BAFTA – redukcia RR - 52% (INR: 2-3) *(Mant J. et al., Lancet, 2007)*
  - WASPO – nežiadúce účinky – 6% vs 33% *(Hart R.G. et al., Ann Intern Med, 2007)*
- Riziko krvácania – INR: 3,5 – 4,0
- HAS-BLED – skóre rizika krvácania ≥ 3 – vysoké riziko
Atrial fibrillation

- Risk of stroke
- CHADS$_2$ – (cardiac insufficiency, hypertension, age, diabetes, stroke)
  \[ \geq 2 \quad \text{high risk} \]
- NOACs - trombin inhibitor - Dabigatran, inhibitors factor Xa – Rivaroxaban, Apixaban, Edoxaban
- HAS-BLED – risk of bleeding \[ \geq 3 \quad \text{high risk} \]
- Risk of bleeding – INR: 3.5 – 4.0
## Recommendations for stroke prevention in patients with atrial fibrillation

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral anticoagulation therapy to prevent thromboembolism is recommended for all male AF patients with a CHA$_2$DS$_2$-VASc score of 2 or more.</td>
<td>I</td>
<td>A</td>
<td>38, 318–321,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>354, 404</td>
</tr>
<tr>
<td>Oral anticoagulation therapy to prevent thromboembolism is recommended in all female AF patients with a CHA$_2$DS$_2$-VASc score of 3 or more.</td>
<td>I</td>
<td>A</td>
<td>38, 318–321,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>354, 404</td>
</tr>
<tr>
<td>Oral anticoagulation therapy to prevent thromboembolism should be considered in male AF patients with a CHA$_2$DS$_2$-VASc score of 1, considering individual characteristics and patient preferences.</td>
<td>IIa</td>
<td>B</td>
<td>371, 375–377</td>
</tr>
<tr>
<td>Oral anticoagulation therapy to prevent thromboembolism should be considered in female AF patients with a CHA$_2$DS$_2$-VASc score of 2, considering individual characteristics and patient preferences.</td>
<td>IIa</td>
<td>B</td>
<td>371, 376, 377</td>
</tr>
</tbody>
</table>
### Recommendations for secondary stroke prevention

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class$^a$</th>
<th>Level$^b$</th>
<th>Ref$^c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticoagulation with heparin or LMWH immediately after an ischaemic stroke is not recommended in AF patients.</td>
<td>III (harm)</td>
<td>A</td>
<td>477</td>
</tr>
<tr>
<td>In patients who suffer a TIA or stroke while on anticoagulation, adherence to therapy should be assessed and optimized.</td>
<td>IIa</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>In patients who suffer a moderate-to-severe ischaemic stroke while on anticoagulation, anticoagulation should be interrupted for 3–12 days based on a multidisciplinary assessment of acute stroke and bleeding risk.</td>
<td>IIa</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>In AF patients who suffer a stroke, aspirin should be considered for prevention of secondary stroke until the initiation or resumption of oral anticoagulation.</td>
<td>IIa</td>
<td>B</td>
<td>485</td>
</tr>
</tbody>
</table>

- **Systemic thrombolysis with rtPA is not recommended if the INR is above 1.7 (or, for patients on dabigatran, if aPTT is outside normal range).**
  - III (harm) | C | 472, 474
- **NOACs are recommended in preference to VKAs or aspirin in AF patients with a previous stroke.**
  - I | B | 363, 482
- **After TIA or stroke, combination therapy of OAC and an antiplatelet is not recommended.**
  - III (harm) | B | 486
- **After intracranial haemorrhage, oral anticoagulation in patients with AF may be reinitiated after 4–8 weeks provided the cause of bleeding or the relevant risk factor has been treated or controlled.**
  - IIb | B | 483, 484, 487
71 years old man

- Isch heart disease
- AF
- AH
- TIA in history
- Hypercholesterolemia
- $\text{CHADS}_2 = 3$
- Treatment – ASA 100 mg, Corvitol, Dicardin, Rasilez

TIA – transient ischemic attack
71 years old man

- iv thrombolysis
- Thrombectomy
- mRS – 4 points

mRS – modified Rankin scale
79 years old woman

- Isch heart disease
- AF
- 1 month after TEP
- CHADS$_2$ = 3
- Treatment – LMWH from TEP, Isoptin, Digoxin, Furosemid, Cardilan, Zyllt
79 years old woman

- Prefrontal syndrome, apathy, weakness of left lower extremity,

- Out of time window – no IVT, no TE

- mRS – 4 → 5 → 6 (after 2M)
Implementing the Proclamation of Stroke and Potentially Preventable Dementias

Vladimir Hachinski\(^1\), Detlev Ganten\(^2\), Daniel Lackland\(^3\), Reinhold Kreutz\(^4\), Konstantinos Tsioufis\(^5\) and Werner Hacke\(^6\); on behalf of the World Stroke Organization, the World Heart Federation, the World Hypertension League and the European Society of Hypertension

Brain health plays a central role in wellbeing and in the management of chronic diseases. Stroke and dementia pose the two greatest threats to brain health, but recent developments suggest the possibility that preventing stroke may also prevent some dementias: 1. A large population study showed a 32\% decrease in the incidence of stroke and a concomitant 7\% reduction in the incidence of dementia; 2. Treatment of atrial fibrillation resulted not only in stroke reduction, but a 48\% decrease in dementia; 3. A hypothesis free analyses has shown that the first phase of Alzheimer disease...
Diabetes mellitus (DM)

- Risk of atherotrombotic strokes, lacunes, dementia
Trombophilia
Z.K., female, 25 years

- 3 days after delivery
- Posit. familial history
- Deficit AT III

Sziklasiová J., .....Gdovinová Z.: Cerebrovasc Dis, 2007
Cryptogenic stroke

- Stroke with Unknown etiology
- AF – 4,9-9,2%
- Better detection – AF cca 25%
- What is the best method – Holter 24 hours, 2 weeks, longer?
- Duration of AF – 30 sek? 6 min?

77-years old woman

**History** – arrhythmia, no AF, Holter – negat., AH

**TO:** headache, weakness of right upper extremity, speech problem

**Brain CT:** Hypodensity P a T region on the left side

**EKG holter:** sinus rhythm, in the last part of Holter – atrial fibrillation about 2 hours

**Conclusion:** paroxysmal atrial fibrillation
Transient ischemic attack

- brief episode of neurological dysfunction caused by loss of blood flow (ischemia) in the brain, spinal cord, or retina, without tissue death (infarction).

- Risk of stroke in 1 month - 8%

- Recommended exam: – Duplex ultrasound of brain arteries, brain CT + CT AG, brain MRI, ECHOcardiography, Holter monitoring, TEE?
Transient ischemic attack

- Dg of TIA – prognostic value

- Early risk of stroke (in 7 days) after TIA + positive imaging (TSI - transient symptoms with infarction) is 15-times higher than risk after stroke.

- 7- days risk of stroke after TSI - 4-16%
- 7- days risk of stroke after stroke - 1-3%

*Sacco RL et al., Stroke 2013, 44:2064-2089; Easton JD et al. Stroke 2009, 40:2276-2293*
Transient ischemic attack

- Neurological examination, pulsation, blood pressure
- Laboratory tests
- Duplex ultrasound of extracranial arteries
- Brain CT, CT AG, if negat. Brain MRI
- Holter monitoring, screening of AF
- Right-left shunt
- ECHOcardiography (TTE, p.p. TEE)
- Internal exam., cardiology
- Hematological examination – screening of trombophilia (< 60y)
- Antithrombotic treatment (antiplatelet, or anticoagulants – AF), CEA, STENT
- Dispensarisation
42-years old man

- Aphasia 30 minutes
- Brain CT negat., **CTAG – not done**
- Cca after 2 hours – again aphasia
- CTAG – MCA l.sin. stenosis
- DSA – occlusion M2 MCA l.sin.
42-years old man

- Brain MRI – ischemia in MCA l.sin territory TE
- MTE – not done

- Doplnené
- Duplex US
- RL shunt
- Holter monitoring
- TEE
- Hematological exam.
- Conclusion: ESUS – embolic stroke of undetermined source
67-years old man

- History: DM, AH, urinary bladder ca, stroek 3 months ago. 3 months parestesia of right extremities.


- Brain CT - 13:00 – older ischemic lesion
67-years old man

- CT AG – subtotal stenosis of ICA l.sin., cca 50% stenosis of ICA l.dx.


- Patient transferred to VÚSCH 1.1.2020 at 01.00
DSA – ICA l.sin. a l.dx.
Endarterectomy
ACC after endarterectomy
Brain CT after CEA

- Small bleeding to ischemic lesion in patient with poorly corrected hypertension
- After 2 weeks - mRS 0-1
Classification of stroke II.

- Territory of a. cerebri media
- Territory of a. cerebri anterior
- Territory of a. cerebri posterior
- Territory of a. bazilaris (vertebrobasilar)
- Territory of a. carotis interna
- Territory of a. carotis communis
ACA – arteria cerebri anterior,
MCA – arteria cerebri media,
PCA – arteria cerebri posterior,
AChA – arteria chorioidea anterior,
SCA – arteria cerebelli superior,
AICA – arteria cerebelli anterior inferior,
PICA – arteria cerebelli inferior posterior,
LSA – lentikulostriatálne artérie.
MCA territory

- The most often embolic etiology – very sudden onset
- Speech disorder, hemiparesis (dominantly on upper extremity, central lesion of n. VII.
- Wernicke – Mann position of the body
ACA territory

- Central paresis of lower extremity
- Disorders of behaviour – prefrontal SY
PCA territory

- Visual field disorders – homonymous hemianopsia
BA territory

- Dizziness, diplopia, nystagmus, hemiparesis or kvadruparesis, hemiplegia alternans, cranial nerves lesions, problems with deglutination and speech
Classification of stroke III.

- Brain infarct
- Lacunar infarct – diameter less than 1.5 cm
Diagnostics of stroke

- Clinical feature
- Brain CT
- **Laboratory tests** – RBC, SR, coagulation, fibrinogen, Na, K, sugar, urea, kreatinin, cholesterol, triglycerids, CRP, TPIT
- Duplex US of carotid arteries
- ECHO cardiography
Patient with stroke – brain CT – basis for treatment decision

Brain hemorrhage

Ischemic stroke – CT AG !!!

a/ negative CT, b-c/ early signs of ischemia – a-c/ we can do IVT, c/ + indication for thrombectomy

Subarachnoid hemorrhage

CT AG !!!

Ischemic stroke – big, old lesion – we cannot do IVT
Brain CT – early signs of ischemia
Brain CT – early signs of ischemia

- CERSTVY TROMBUS V A. CEREBRI MEDIA L. SIN.
Brain CT – ischemia
Brain CT – ischemia
Brain CT – ischemia
„Wake-up stroke“

Brain MR – FLAIR

Brain MR – DWI
Stroke therapy

- **Acute**
  1/ Thrombolysis - rt-PA (recombinant tissue plasminogen activator) ≤ 4.5 hours after first symptoms!
  2/ Thrombectomy ≤ 6 hours after first symptoms!
  3/ ASA – 325 mg – later than 6 hours

- 1/ - i.v. rt-PA 0,9 mg/kg
- Brain CT – negative, early signs of ischemia
Neliečný pacient stráca v ischemickej oblasti približne 1,9 milióna neurónov každú minútu.

Reperfúzia ponúka možnosť redukcie rozsahu ischemického poškodenia.

Ischemické jadro (mozgové tkanivo smerujúce k nekróze)

Penumbra (zachrániteľná časť mozgu)

The goal of therapy

Compartments of Infarct Development

Penumbra: moderate ischemia
delayed infarction

Core: dense ischemia
erly infarction
ECASS III

NNT – 4-5/90 min., 9/3h, 14/3-4.5h
Trombolysis
Endovascular treatment
Solitaire retriever, Trevo pro retriever
Digital subtraction angiography
Intravenous thrombolysis/million inhabitants

deSousa DA, Fischer U et al., survey from 43 countries, zaslané do tlače
Figure 6: Contemporary annual rates of intravenous thrombolysis (IVT) per million population in 42 European countries.
Endovascular treatments/million inhabitants

deSousa DA, Fischer U et al., survey from 43 countries, zaslané do tlače
Figure 7: Contemporary annual rates of endovascular treatments (EVT) for ischaemic stroke per million population in 43 European countries
New guidelines in Slovakia

- Network of hospitals for IVT and ET – 24/7 hours
- Recommendations for collaboration with emergency service
CTA/MRA

- Brain CT and CT AG
- Sugar
- aPTT, PT (INR), - in patients with anticoagulant therapy
- Mild neurological deficit, age > 80 years, epileptic seizure - not contraindication

Network of hospitals

- Poskytovaná rekanalizačná liečba – trombolytická liečba (43)
- Poskytovaná rekanalizačná liečba – trombolytická aj trombektomická liečba (6)
- Poskytovaná rekanalizačná liečba – trombektomická liečba (2)
New goals after thrombectomy trials

- **T=0**
  - Suspected stroke patient arrives at stroke unit

- \( \leq 20 \text{ min} \)
  - Patient evaluated on CT table
  - CT & labs (INR POC) interpreted

- \( \leq 30 \text{ min} \)
  - rt-PA bolus given (if patient is eligible) in the CT

- \( \leq 60-90 \text{ min} \)
  - Groin puncture if patient is eligible
O.R. 52-years old woman

- Wake up - 5.45, she felt down, aphasia, right side hemiparesis
- Emergency
- 6.50 – hospital, NIHSS - 11
- 7.05 – brain CT
- 7.45 – rTPA
- 9.05 – DSA, trombektomy
O.R. 52-years old woman

DSA before TE

DSA after TE
O.R. 52-years old woman

- Brain CT after 24 hours
- mRS – 0 at time of discharge
„Wake-up stroke“

**Brain MRI**
67-y, waked-up at 5.30 – left side hemiparesis, NIHSS – 10 bodov
Recanalisation TICI2b
mRS – 1, after 3 months - 0
ASPECTS

Normal – 10
Ischemia – 1 point

Score $\geq 7$ better prognosis
ICA stenosis
ICA stenosis
ICA stenosis
Duplex of carotid arteries and AG
Therapy after acute stroke

- Therapy of risk factors – prevention
- Antithrombotics
- Anticoagulants
- Endarterectomy (CEA)
- STENT
- Rehabilitation
Guidelines for antiagregants

- Antithrombotics
- **Non cardioembolic strokes**
  - ASA, 50 – 325 mg 1xD
  - Combination ASA and dipyridamol 200 mg 2xD
  - Clopidogrel 75 mg 1xD

Albers GW a kol., *Chest* 2001;
Indications for anticoagulants in patients with stroke and AF

- CHADS$_2$ – (congestive heart failure, hypertension, age $\geq 75$, diabetes, stroke)
  $\geq 2$ – high risk

- Warfarin – INR 2.0-3.0

- Direct oral anticoagulants – are recommended instead of warfarin – safety

- Direct inhibitor of thrombin – Dabigtran

- Inhibitors of Xa – Apixaban, Rivaroxaban, Edoxaban
<table>
<thead>
<tr>
<th>Charakteristika štúdií</th>
<th>RELY dabigatran</th>
<th>ROCKET AF rivaroxaban</th>
<th>ARISTOTLE apixaban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanizmus účinku</td>
<td>Ila</td>
<td>Xa</td>
<td>Xa</td>
</tr>
<tr>
<td>Počet pacientov</td>
<td>18 113</td>
<td>14 264</td>
<td>18 201</td>
</tr>
<tr>
<td>Dávkovanie</td>
<td>150 mg 2x/ day</td>
<td>20mg 1x/ day (15mg 1x/ day)</td>
<td>5mg 2x/ day</td>
</tr>
<tr>
<td></td>
<td>110 mg 2x/ day</td>
<td></td>
<td>2,5 mg 2x/ day</td>
</tr>
<tr>
<td>Dizajn</td>
<td>PROBE</td>
<td>Double blind</td>
<td>Double blind</td>
</tr>
<tr>
<td>Priemer CHADS₂</td>
<td>2,1</td>
<td>3,5</td>
<td>2,1</td>
</tr>
<tr>
<td>Priemer TTR</td>
<td>64%</td>
<td>55%</td>
<td>62%</td>
</tr>
<tr>
<td>Medián TTR</td>
<td>67%</td>
<td>58%</td>
<td>66%</td>
</tr>
<tr>
<td>Prerušenie liečby (Warfarín)</td>
<td>21,2% (16,6)</td>
<td>23,9% (22,4)</td>
<td>25,3% (27,5)</td>
</tr>
</tbody>
</table>

Endarterectomy ICA

- Indications
  - ACI stenosis > 70% (in ulcerating AS plaques – risk of embolisation – > 60%)
  - Brain CT
  - After TIA – 2 days, small infarct within 2 weeks, others – 6 weeks after stroke
Endarterectomy
Endarterectomy
Digital subtraction angiography
ICA
High grade stenosis - Stent
ICA
High grade stenosis - Stent
ICA
High grade stenosis - Stent
Indications of STENT

- Patients with
  - operation risk
  - older patients
  - risk of anaesthesia
  - changes on the neck
- Restenosis after CEA
Advantages of STENT

- Less invasive method
- Less patients with restenosis
- Shorter hospitalization
- Smaller risk of wound complications
Blood supply of spinal cord
Blood supply of spinal cord

- Anterior spinal artery
- Sulcal artery
- Posterior spinal arteries
- Radicular arteries (Posterior, Anterior)
- Dorsal root ganglion
- Spinal artery
- Arachnoid
- Dura mater
- Internal vertebral venous plexus
- Vertebral artery
- Cervical radicular artery
- Aorta
- Thoracic radicular artery
- Radicularis magna (artery of Adamkiewicz)
- Thoracolumbar
- Sacral
Acute spinal cord ischemia

- Represents only 5-8% of acute myelopathies and <1% of all strokes
- The majority of patients developed symptoms quickly, with maximal symptomatology reached within 12 hours for >50% of patients and within 72 hours for the vast majority of patients
- Initial symptoms include severe back pain (60-70%), loss of bladder control (60%) and bowel control (40%).
Clinical feature

- **anterior spinal artery syndrome**
  - paralysis below affected level (initially flaccid; later spastic)
  - pain and temperature sensory loss
  - relative sparing of proprioception and vibration (dorsal columns)
- **posterior spinal artery syndrome**
  - complete sensory loss at the level of injury
  - proprioception and vibration loss below level
  - minimal, typically transient, motor symptoms
MRI

T2-weighted MRI
Owl's Eye in Spinal Magnetic Resonance Imaging
Haematomeylia

- Bleeding to spinal cord
- Etiology
  - AVM
  - Anti-coagulant therapy
  - Coagulopathies
  - Injury
Haematomeylia - etiology
Hematomyelia – clinical feature

- Pain
- Symptoms similar as in ischemia
- Diagnosis – MRI
- Treatment – conservative, surgery
Hematomyelia - MRI
Cerebral venous thrombosis (CVT)

- Rare type of stroke
- Thrombosis occurs in the venous side of the brain circulation
- Occlusion of one or more cerebral veins and dural venous sinus.
- Incidence – 1/100 000 inhabitants
- The most frequent – children and young adults, more often in women
Etiology

Infections (in 70% - Staphylococcus aureus, than Streptococcus pneumoniae, gramnegative bacteria, Aspergillus).

- Focal infections on the head – sinusitis, meningitis, malignancy, otitis, tonsilitis, furunkul, penetrating head injury
- Generalized infections – endokarditis, tuberkulosis, pneumonia, hepatitis, AIDS.
- Lumbal puncture
Cerebral venous thrombosis (CVT)

- Non infectious risk factors
  - Oral contraceptives,
  - Drugs with protrombotic effect
  - Pregnancy, puerperium
  - Thrombophilic disorders,
  - Antiphospholipid syndrome
  - Malignancies
Cerebral venous thrombosis
Clinical feature

- Subacute beginning
- Different neurological symptoms
- Later – hemorrhagic transformation
- Cefalea, nauzea, vomitus
- Hemiparézis, paraparesis (sinus sagitalis superior),
- Aphasia,
- ataxia, chorea, hemianopsia,
Cerebral venous thrombosis
Clinical feature

- Epileptic seizure
- Papil oedema
- Cranial nerve lesions - (n. VI, n. VII, n. VIII).
- syndrom foramen jugulare (n. IX – XII.)
Sinus cavernosus thrombosis (SC)
Sinus cavernosus thrombosis (SC)

- very rare, life-threatening condition that can affect adults and children.
- Symptoms
  - Severe headache
  - Swelling, redness, or irritation around one or both eyes
  - Drooping eyelids
  - Inability to move the eye
  - High fever
  - Pain or numbness around the face or eyes
  - Fatigue
  - Vision loss or double vision
  - Seizures
Sinus cavernosus thrombosis - MRI
Sinus transversus thrombosis

- Sy intracranial hypertension
- a temporal symptomatology
Sinus sagitalis superior thrombosis

- Spastic monoparesis of lower extremity
- Or spastic paraparesis of lower extremities
- Or unilateral hemiparesis
Cortical vein thrombosis

- Clinical feature
- Focal deficit – aphasia, hemiparesis, hemianopsya, hemianopsya,
Diagnosis

- Clinical feature – SIH
- Diagnosis – MRI with contrast
- CSF - proteino-cytologic association, in 10 % - CSF negative
- Etiology
Treatment

- Anticoagulants iv, or sc (heparin, alebo LMWH)
- After stabilization – p.o. anticoagulants (Warfarin) INR 2.0 – 2.5 for 6 months, when thrombophilia is present – long lasting
- When there is no effect of heparin – rTPA
- Antibiotics (ceúhalosporins)
- Symptomatic treatment (antiedematous treatment, antiepileptics)