

# Brain Tumors and Neuro-oncology



*Attila G Bagó, MD, PhD*  
National Institute of Neurosurgery  
Dept.of Surgical Neuro-oncology

# **Neuro-oncology**

## **Complex therapy of CNS tumors**

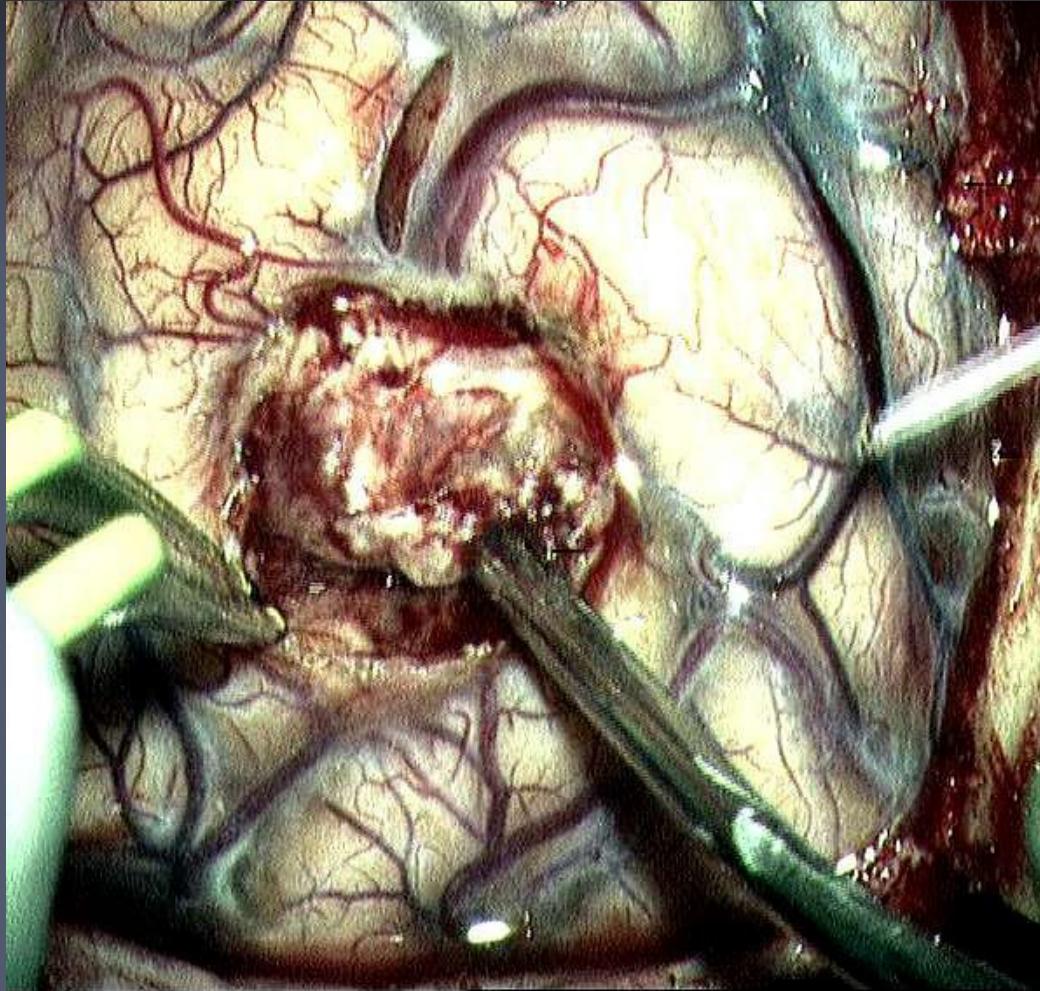
- Diagnostic: tumor or other?
- Therapy:      surgery  
                  radiotherapy  
                  chemohearpy
- Supportive therapy, neuro-oncology care
- Research and clinical trials

# Brain cancer - facts

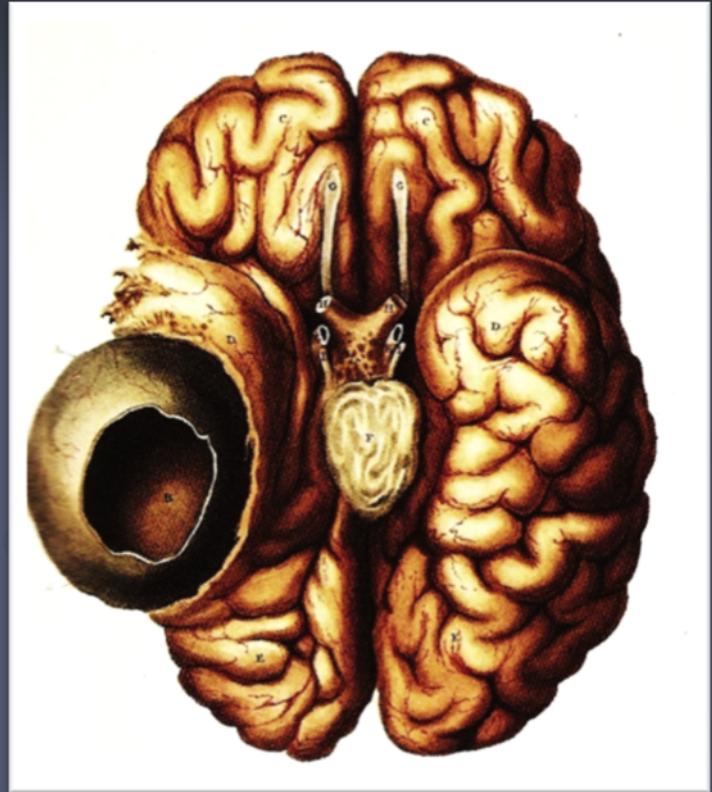
- Life threatening condition
- Brain tumor patients ↑
- Long surviving oncology patients ↑  
brain metastases ↑
- Neuro-oncology care not well organized

**about 4000 pts/year/Hungary**

# Why do we operate brain tumors?



# **LIFE THREATENING DISEASE**

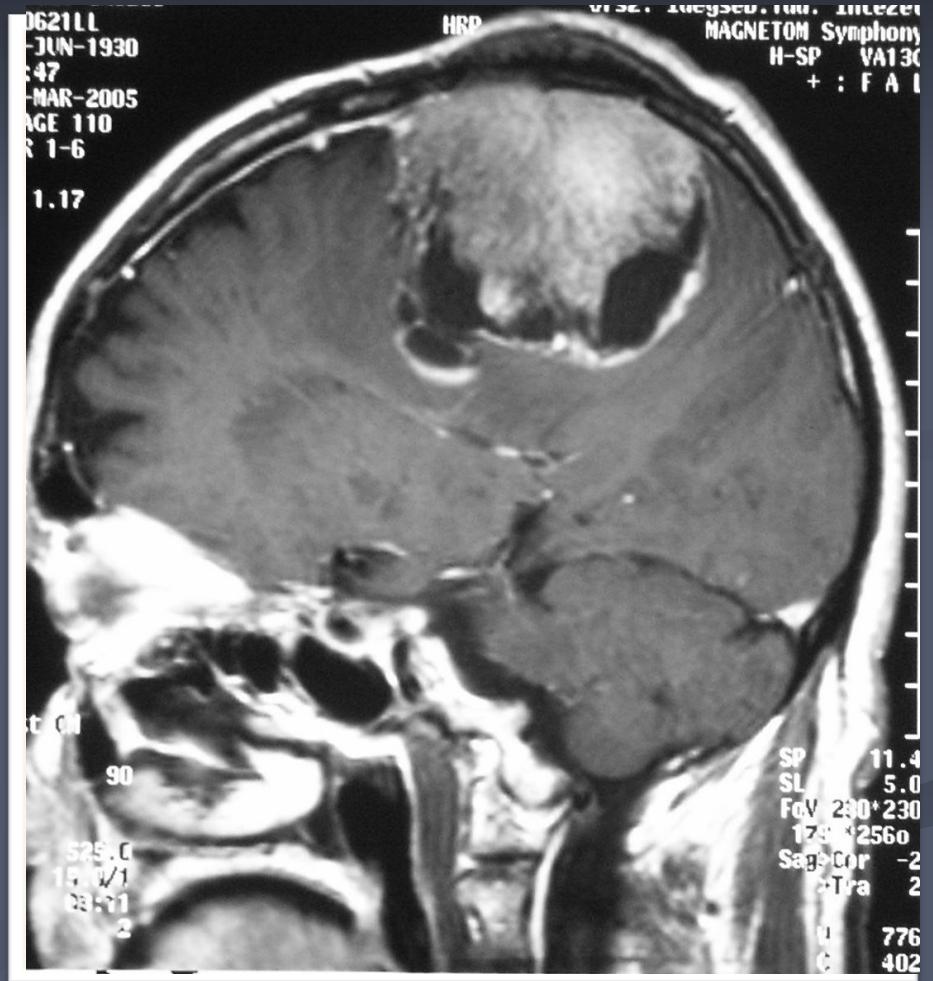


# Monro-Kellie doctrine

- Skull „closed box”
- Brain + CSF + Blood
- Compensatory mechanisms



**HERNIATION**

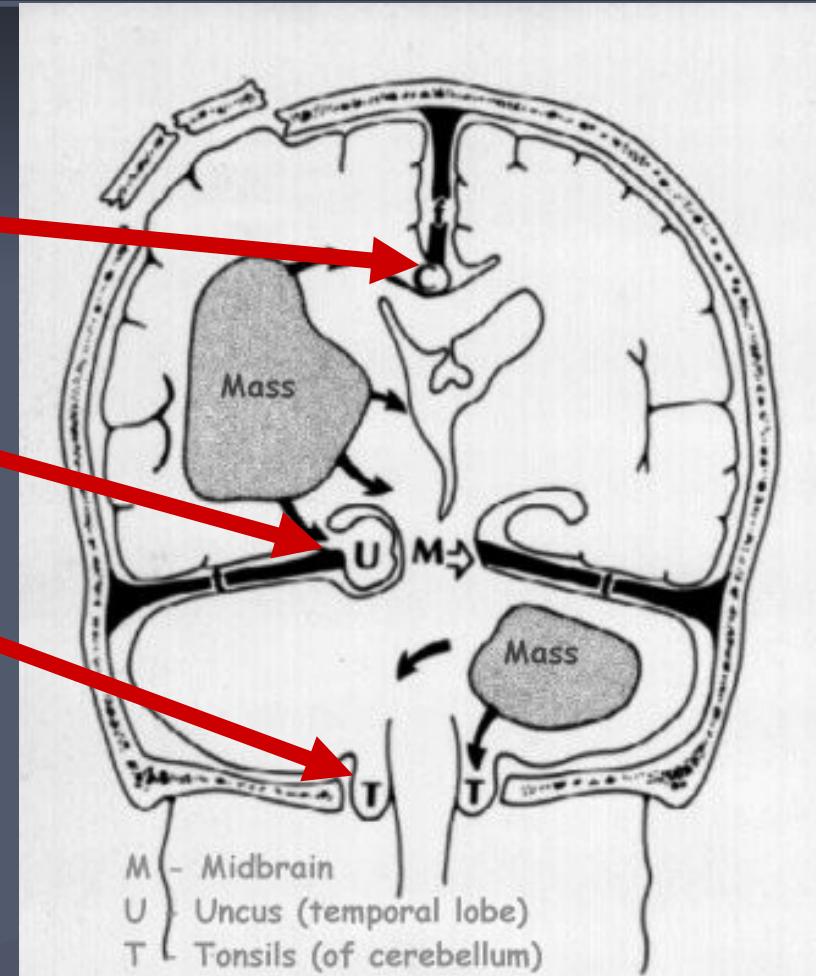


# Herniations

Subfalcial

Temporal/uncal

Tonsillar/cerebellar



# Most common brain tumors

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## Primary

Gliomas

low grade gliomas

high grade gliomas

Meningiomas

Pituitary adenomas

Vestibular schwannomas

## Secondary (2x)

Metastases

lung cancer

breast cancer

colorectal cancer

malignant melanoma

Lymphoma

# Most common brain tumors

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## Primary

### Gliomas

low grade gliomas

high grade gliomas

Meningiomas

Pituitary adenomas

Vestibular schwannomas

## Secondary (2x)

### Metastases

lung cancer

breast cancer

colorectal cancer

malignant melanoma

Lymphoma

# Most common brain tumors

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Primary  
**Glioblastoma  
multiforme (GBM)**

Meningiomas  
Pituitary adenomas  
Vestibular schwannomas

Secundary (2x)

Metastases  
lung cancer  
breast cancer  
colorectal cancer  
malignant melanoma  
  
**Lymphoma**

# Clinical presentation

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## Focal neurological symptoms

- + irritation: **seizure**
- - deficit: **paresis, sensory loss, hemianopsia**

## General symptoms of elevated ICP

- Headache, vomiting
- Level of consciousness, personality changes

**Symptomatology is  
PROGRESSIVE**

# **IMPORTANT**

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**Primery malignant  
brain tumors  
(gliomas)**

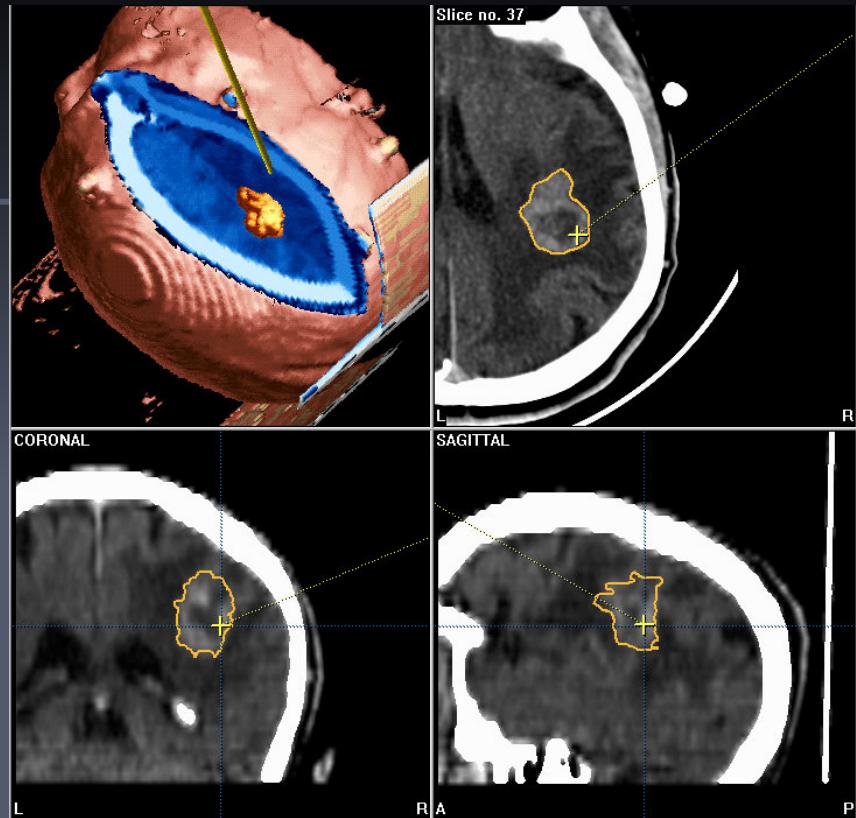
**SURGICALLY  
INCURABLE!**

**Metastatic  
tumors  
(solitaer, oligo)  
benign  
extraparenchymal  
tumors**

**SURGICAL DISEASE**

# IMPORTANT

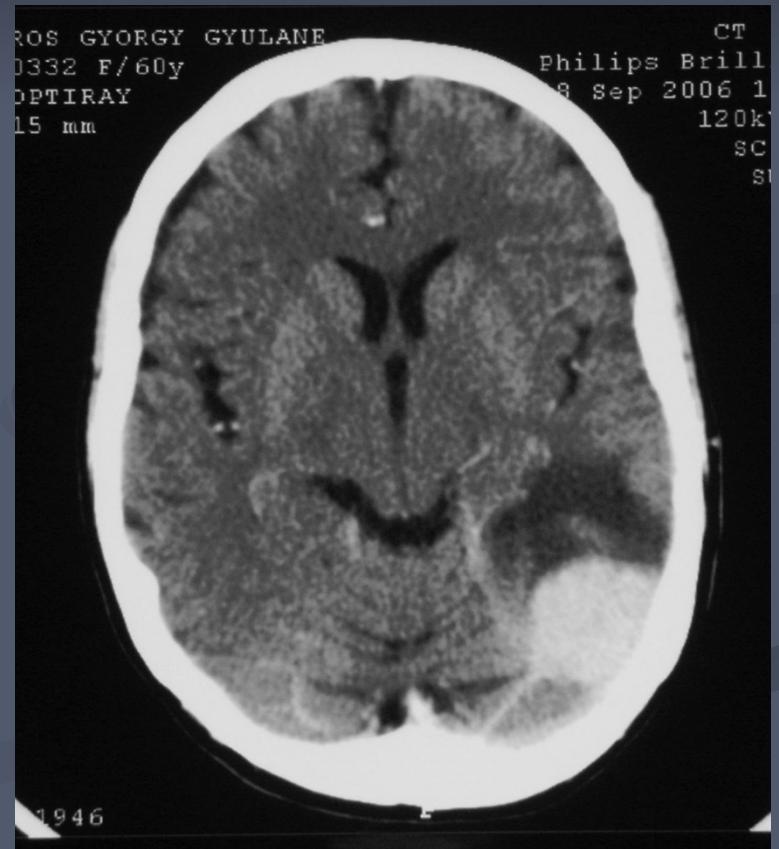
- Oncology patient
- New neurological symptom

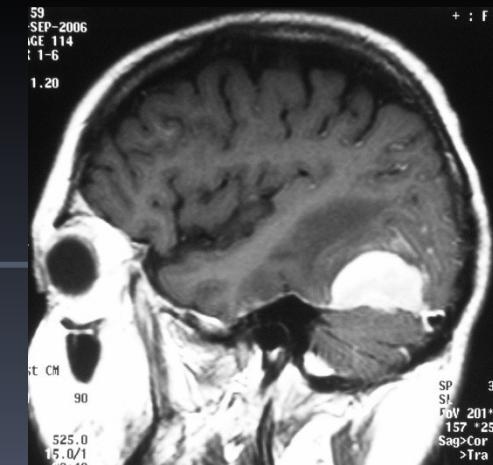
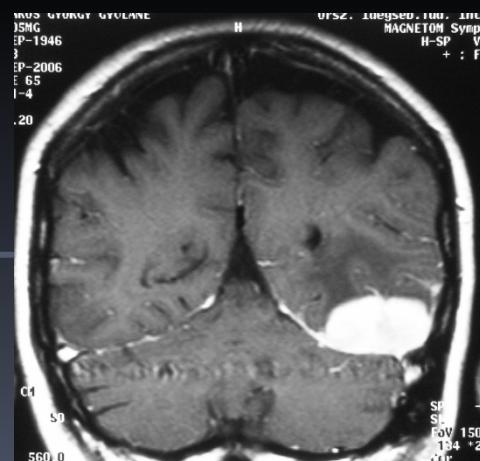
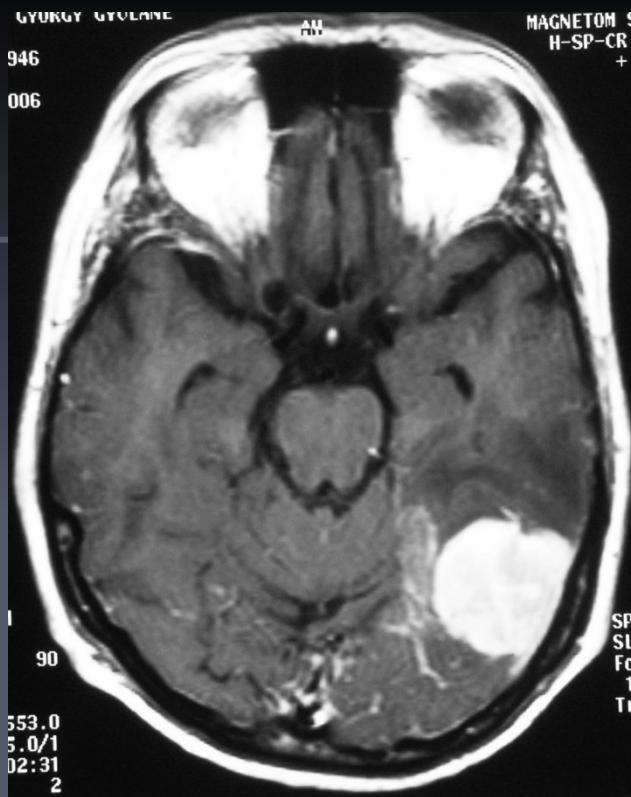


**Rule out brain met!**



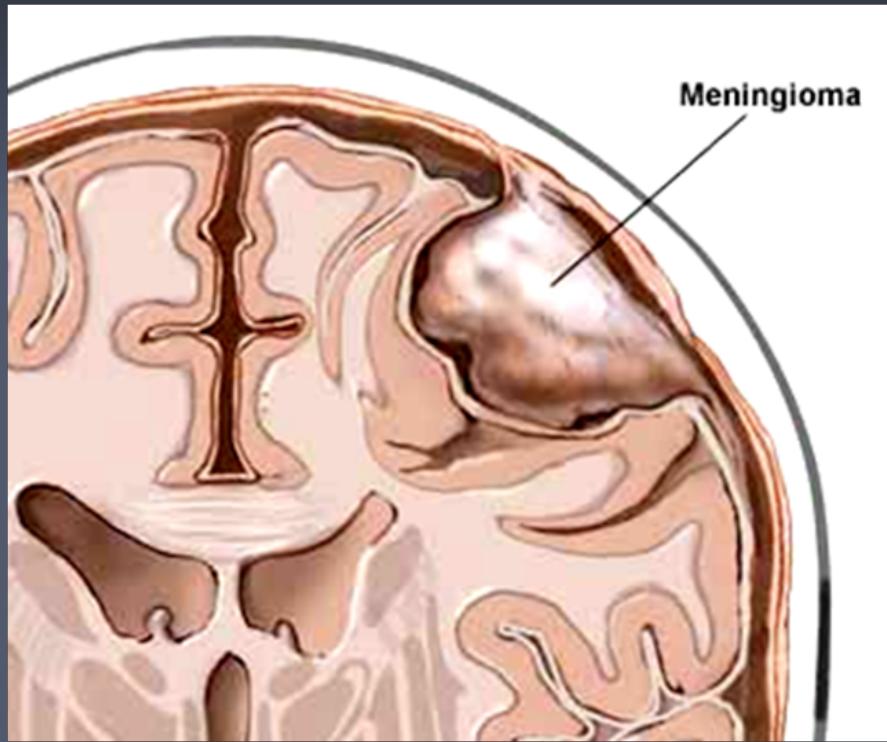
CT





MR

# Meningioma



# Meningioma



Ex: 23827

Se: 5

Im: 10

DFOV 240.0 mm

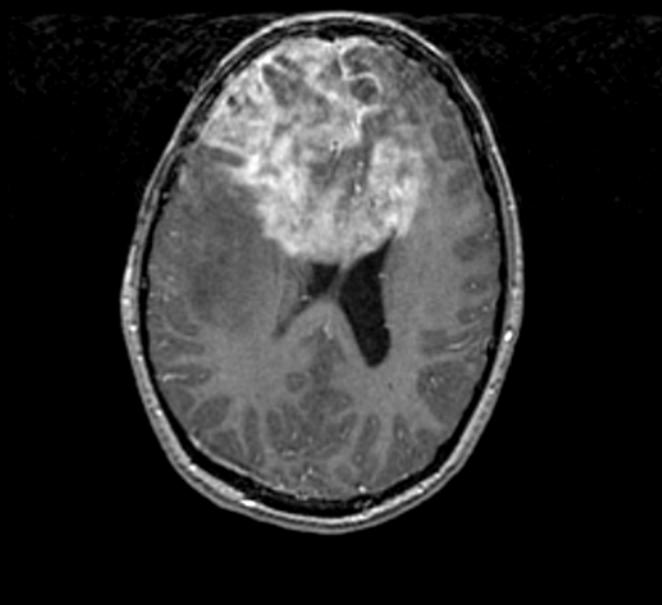
KOVARI AR

10/2

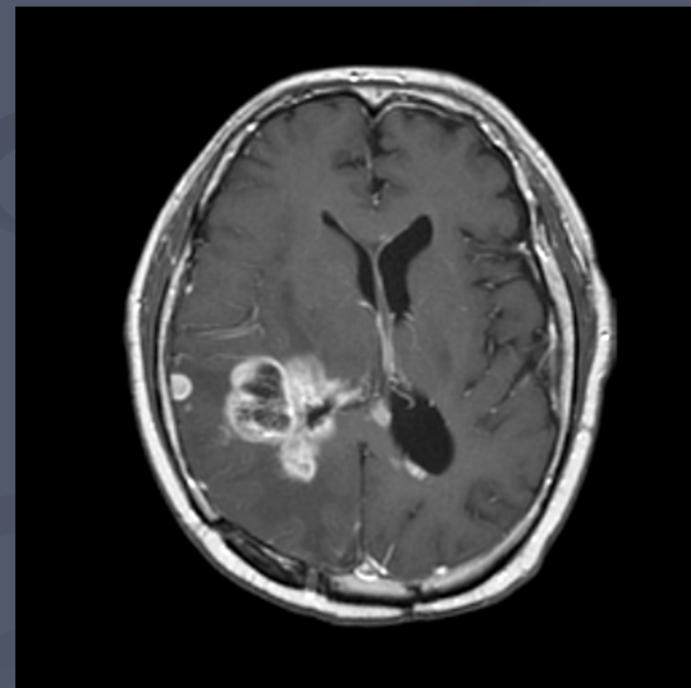
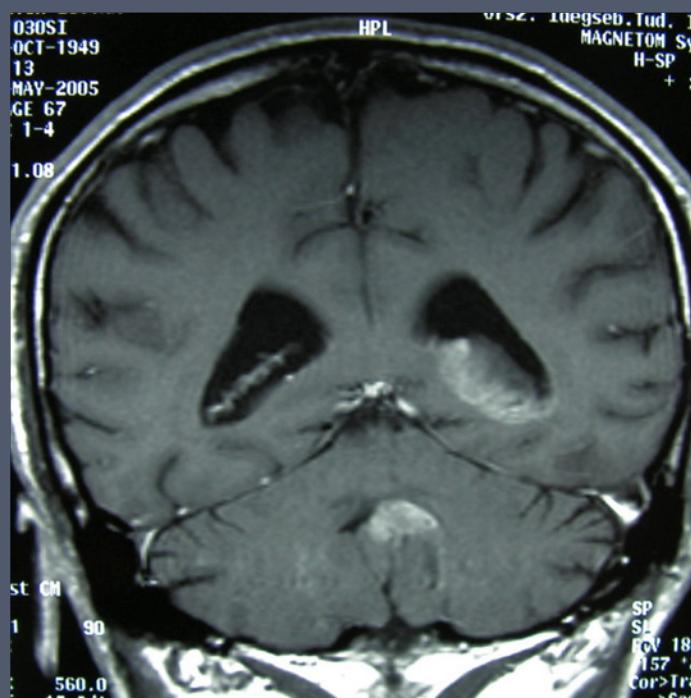
R

5.0 mm

13:12:50

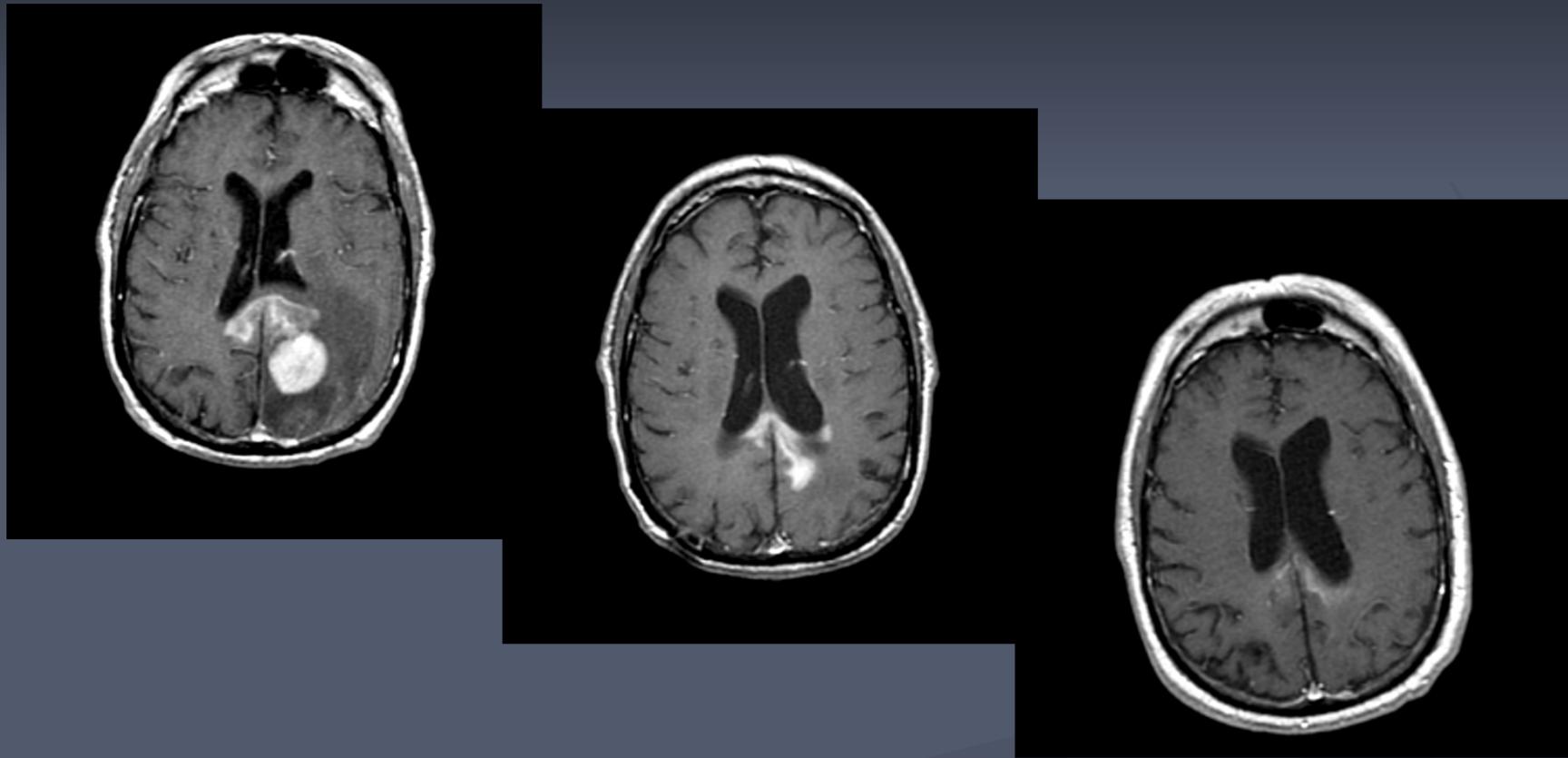


GBM

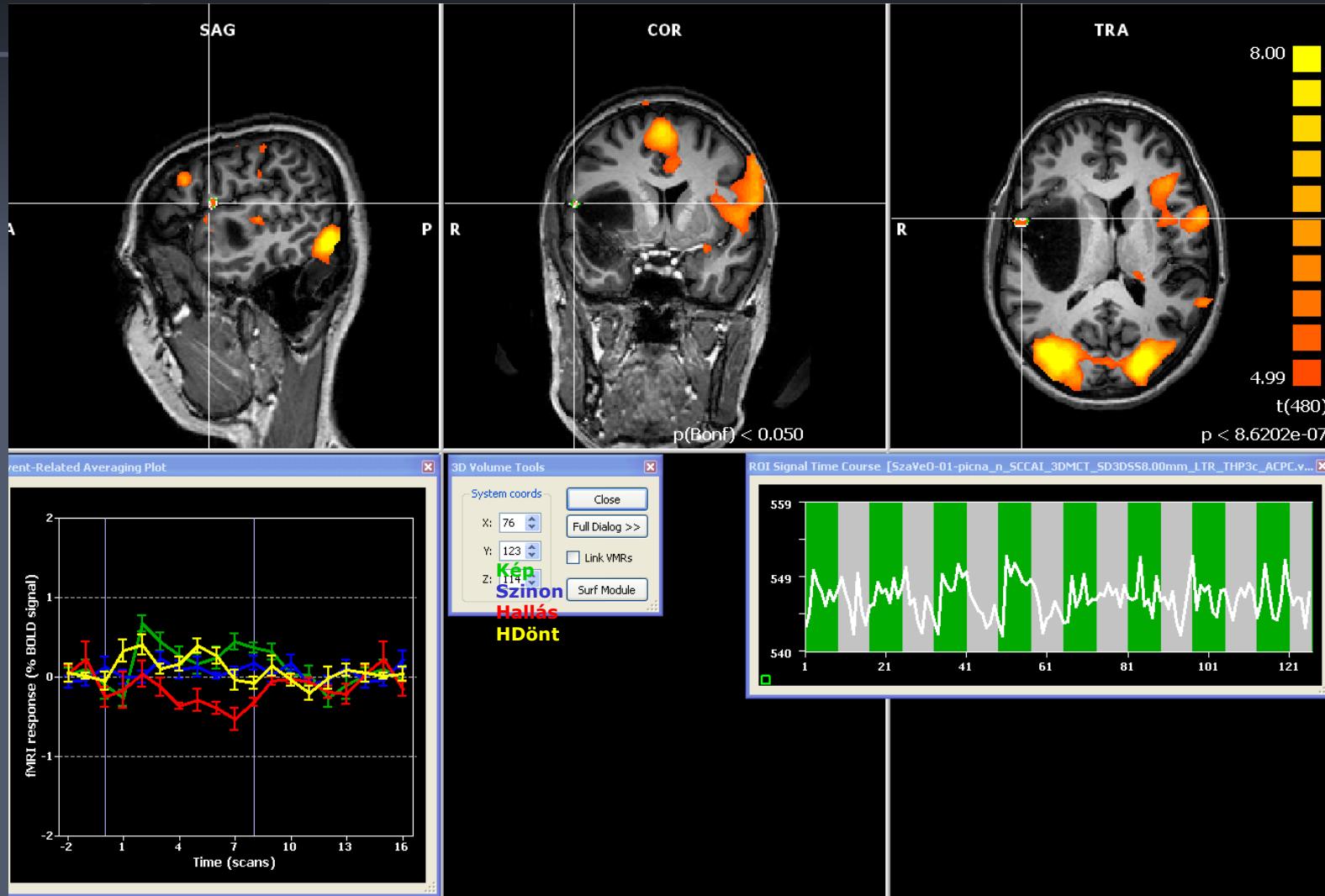


# CNS Lymphoma

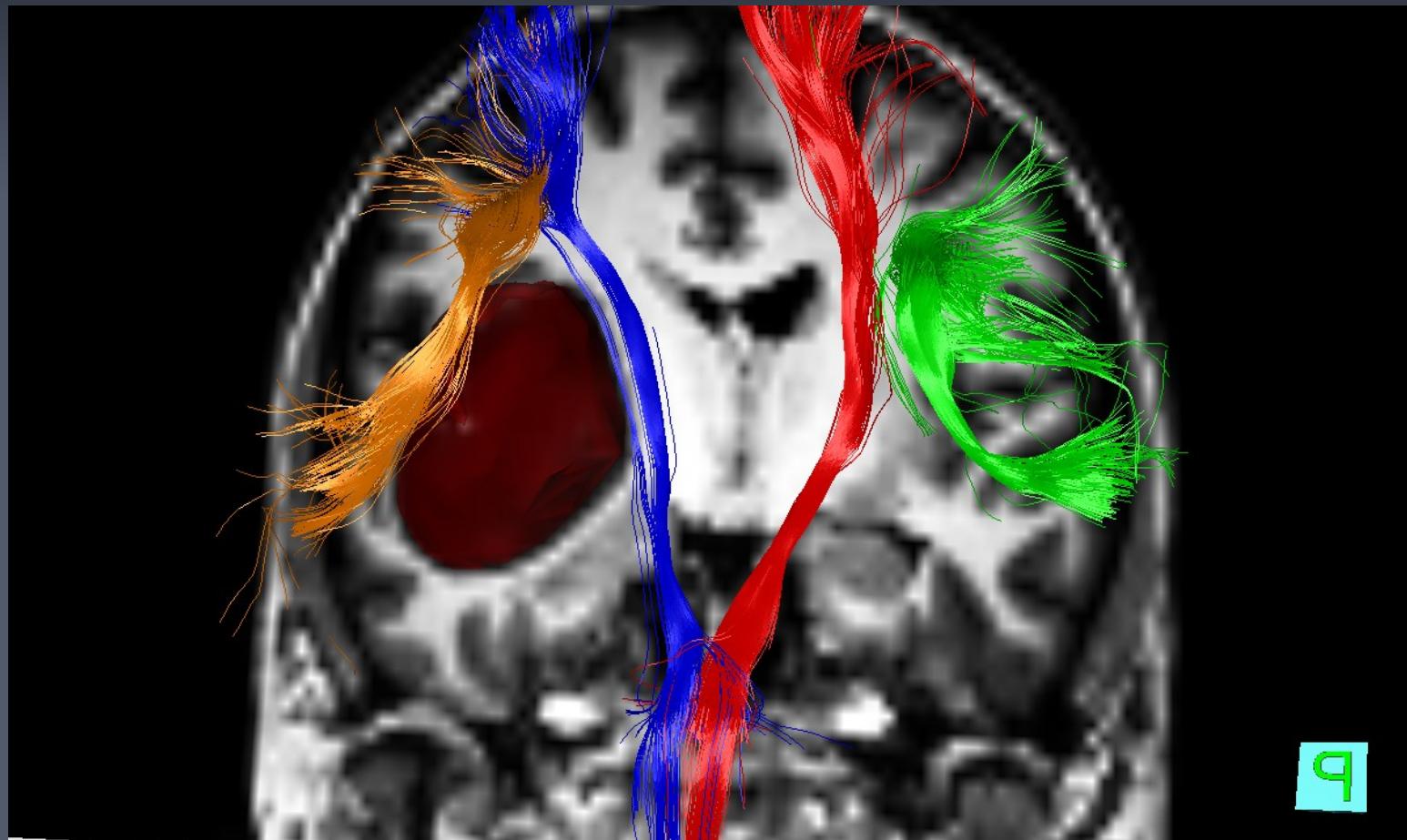
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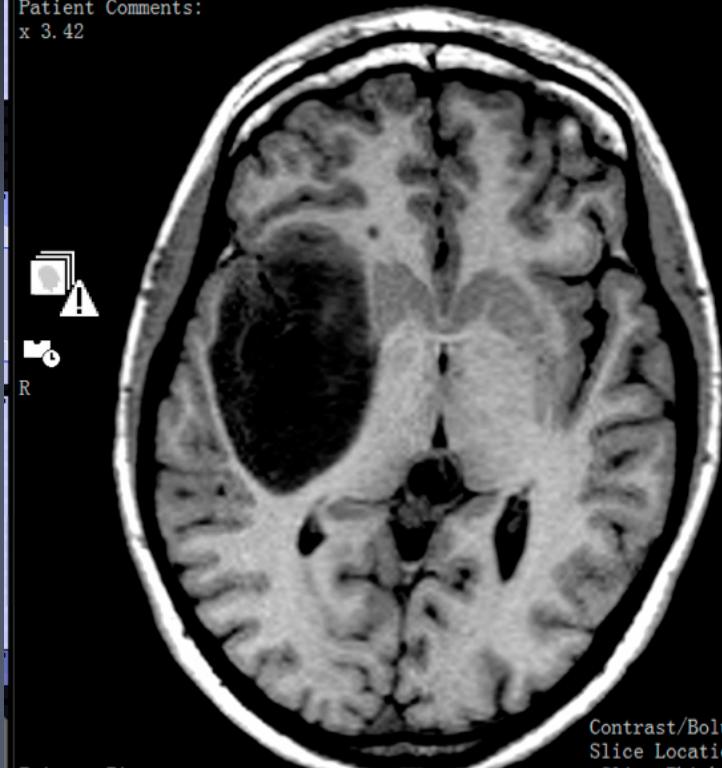
# fMRI



# DTI tractography



ID:093904452  
DoB:1983.09.06  
Acquisition Date:2014.06.04  
Acquisition Time:7:55:42  
Image Number:270  
Patient Comments:  
x 3.42



Trigger Time:  
Inversion Time:300.00  
Repetition Time:11.08  
Echo Time:4.30  
Acquisition Matrix:0/512/2...  
Scan Options:

Contrast/Bolus Agent:  
Slice Location:-30.00  
Slice Thickness:1.00  
Flip Angle:15.00

Percent Phase Field of ...

Image Comment:

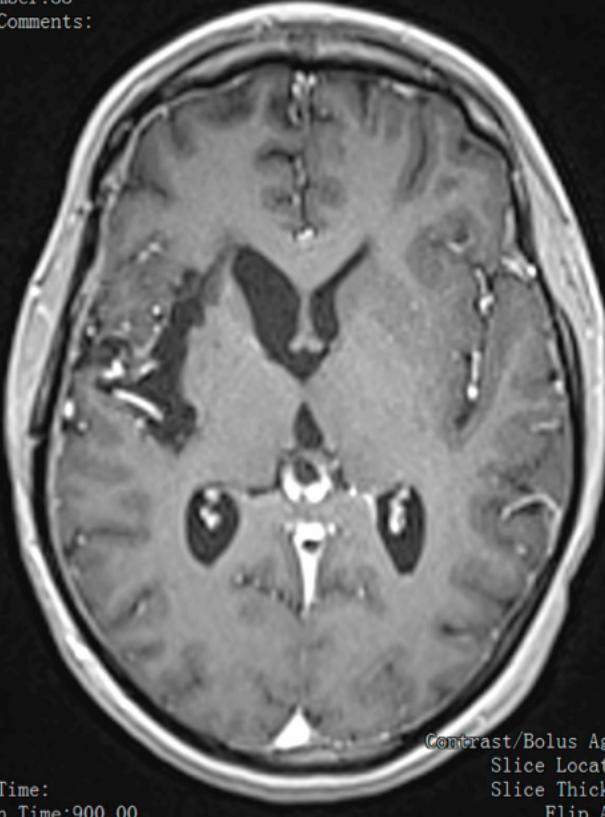
W : 00067

C : 00071

Trigger Time:  
Inversion Time:900.00  
Repetition Time:1560.00  
Echo Time:2.55  
Acquisition Matrix:0/256/1...  
Scan Options:IR

Manufacturer's Model Name: SI  
Body Part Examined:HEAD  
87/179

ID:093904452  
DoB:1983.09.06  
Acquisition Date:2014.12.15  
Acquisition Time:12:19:57  
Image Number:88  
Patient Comments:  
x 3.45



Manufacturer's Model Name: SI  
Body Part Examined:HEAD  
88/166

Contrast/Bolus Agent:Om..  
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Slice Thickness:1.0  
Flip Angle:8.0

Percent Phase Field of ...

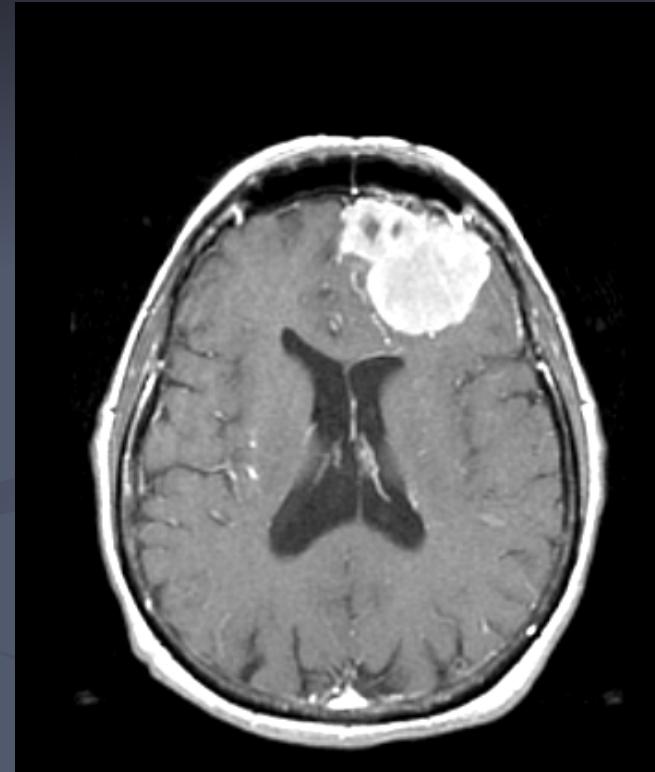
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# Treatment options

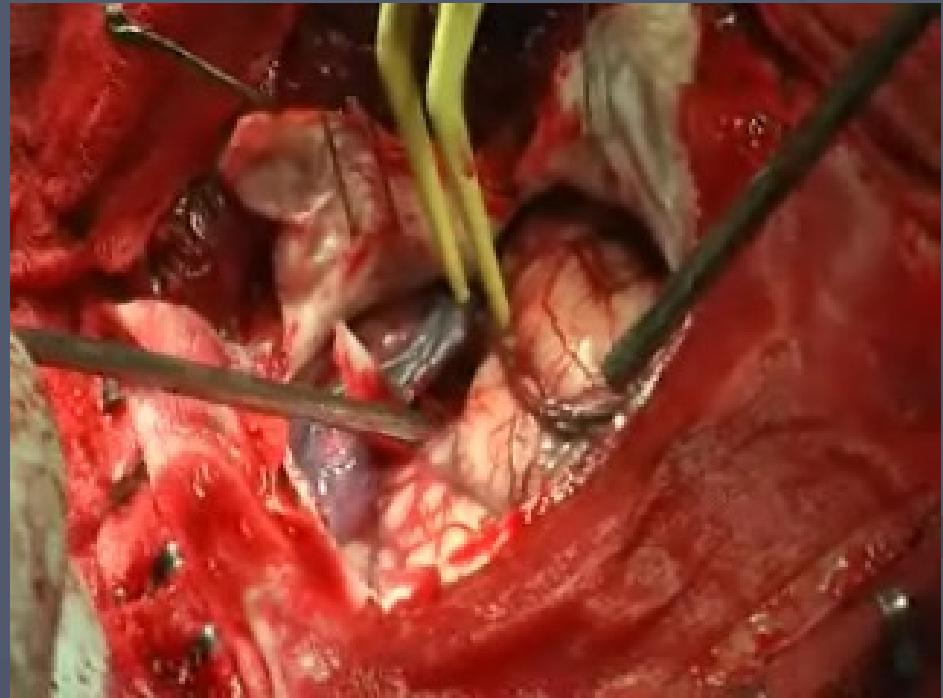
- Surgery
  - Radio-surgery
- Radiotherapy
  - Chemo-radiation
- Chemotherapy



Histology is mandatory!

# Brain tumor surgery

- Maximal radicality
- Minimal morbidity
- Histology



# Brain tumor surgery

- Maximal radicality
- Minimal morbidity
- Histology

- Age
- Performance status
- Release of mass effect
- Localization (multifocal,  
eloquent, axial)
- Met: primary tumor, staging

# Brain tumor surgery

- Maximal radicality
- Minimal morbidity
- Histology

- Total removal
- Stereotactic biopsy
- Open biopsy / debulking

- Age
- Performance status
- Release of mass effect
- Localization (multifocal, eloquent, axial)
- Met: primary tumor, staging

# Brain tumor surgery

- Maximal safe resection
- Verified by postop imaging
- NCCN 2009

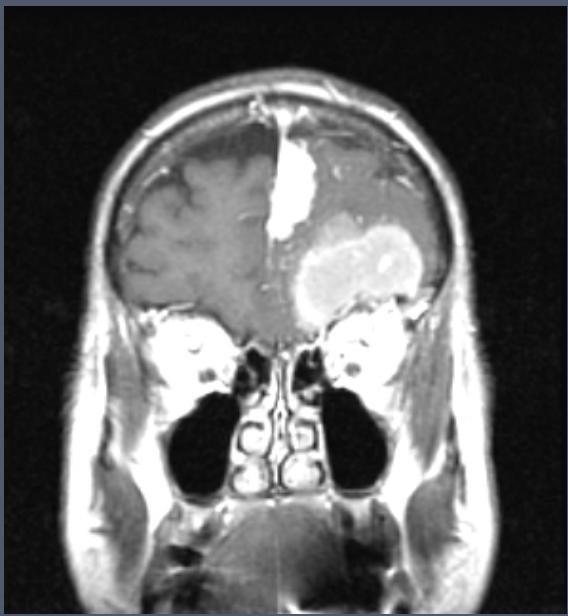
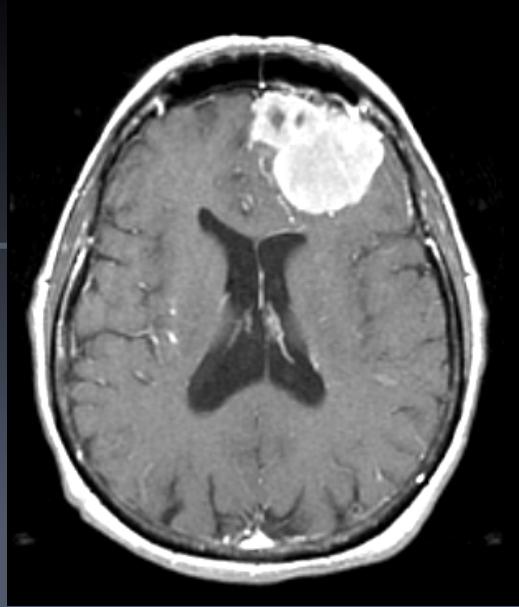
- Total removal
- Stereotactic biopsy
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# Brain tumor surgery

- Maximal safe resection
- Verified by postop imaging
- NCCN 2009

- Total removal
- Stereotactic biopsy
- Open biopsy / debulking

**24-72h postop  
CT/MRI with contrast**

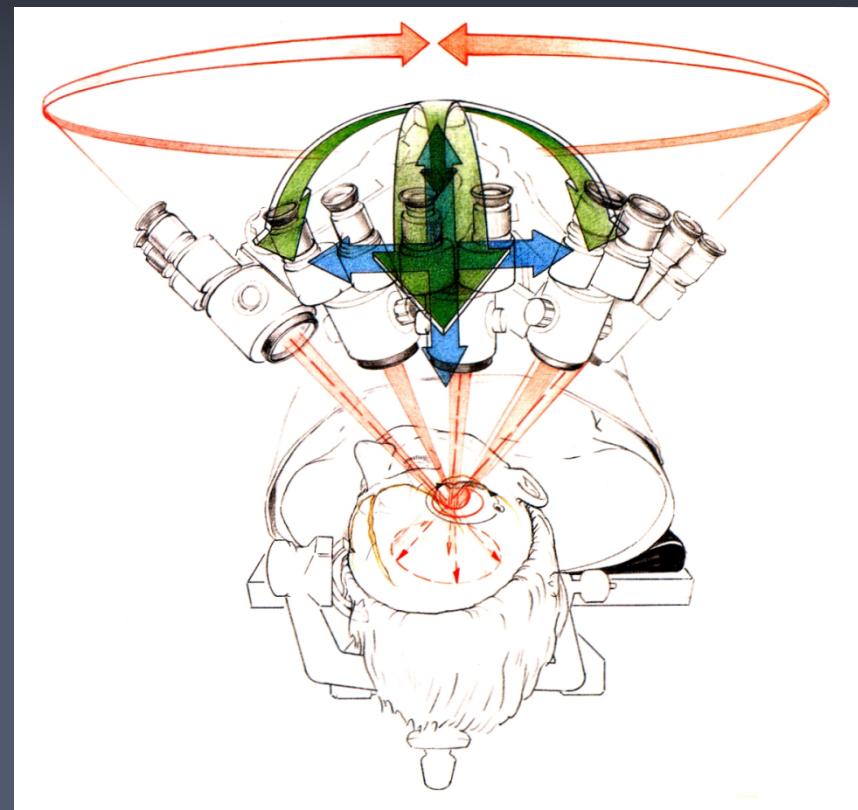
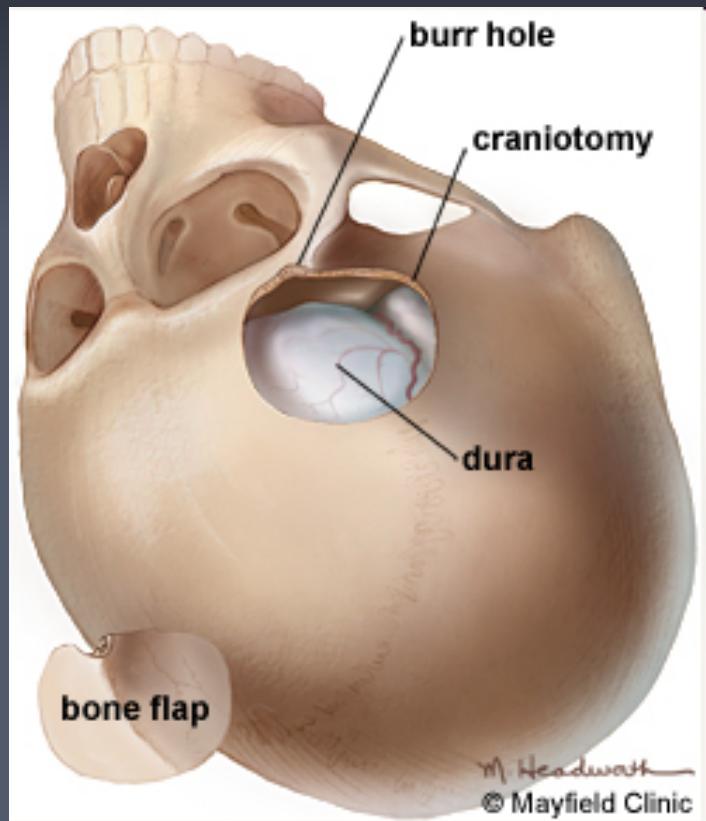


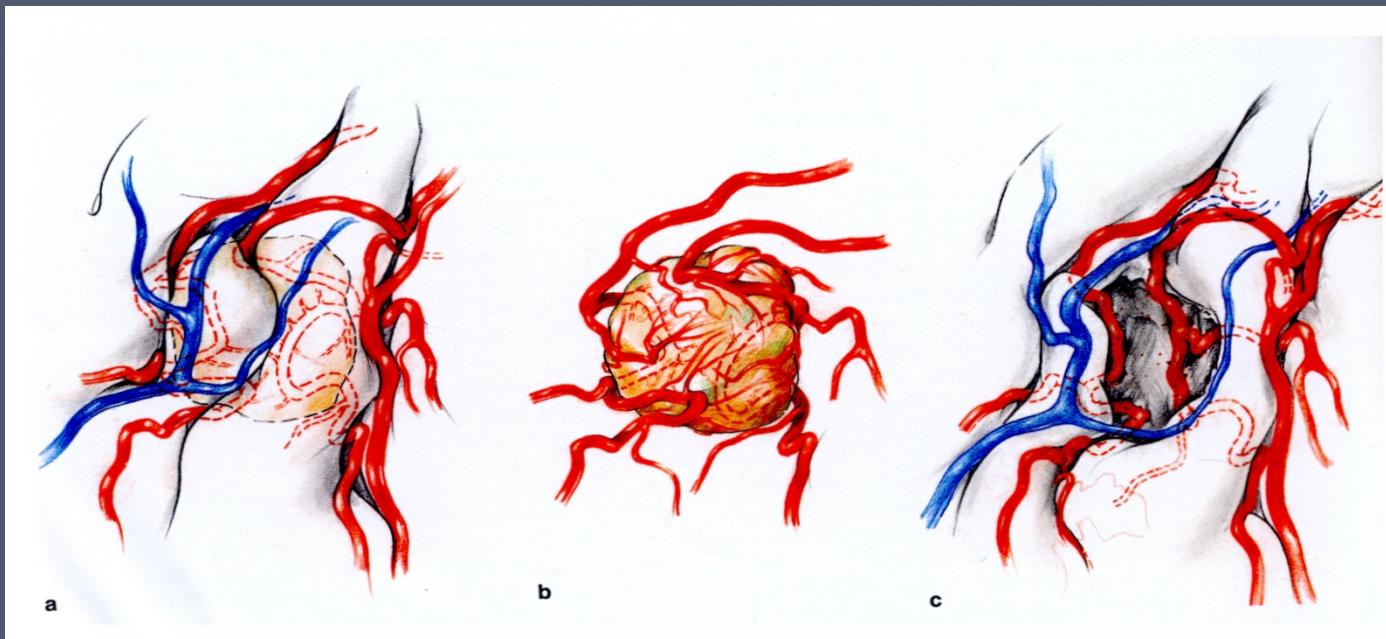
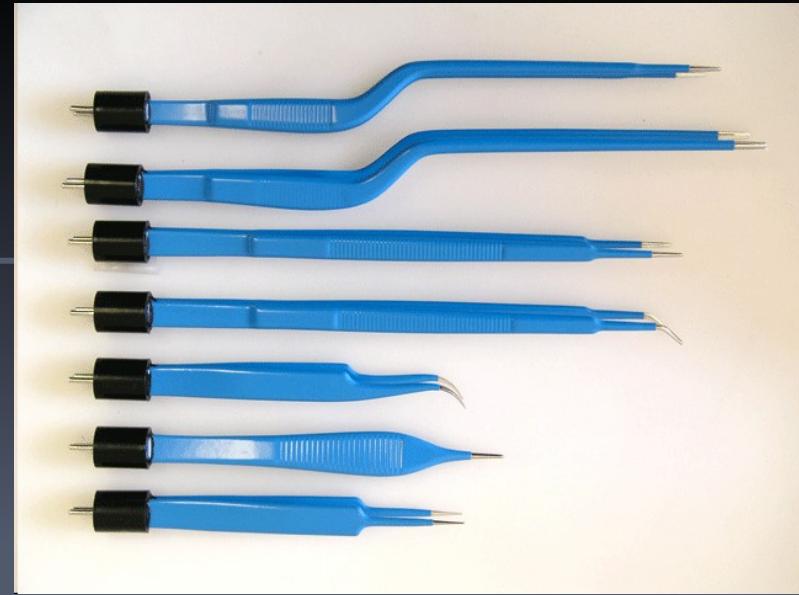
# Brain tumor surgery

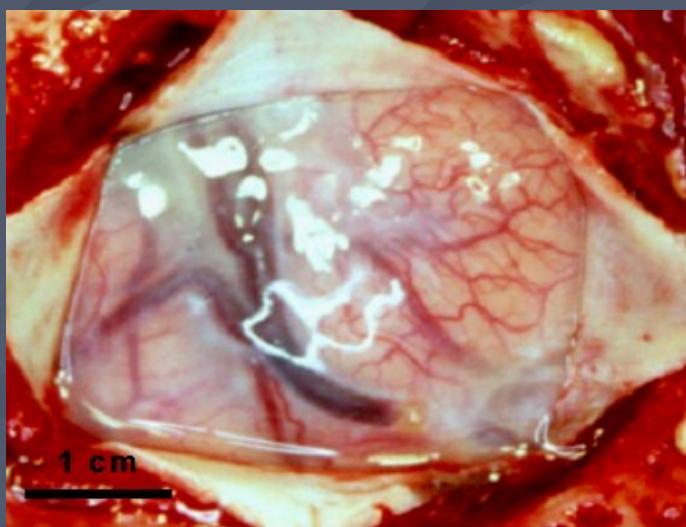
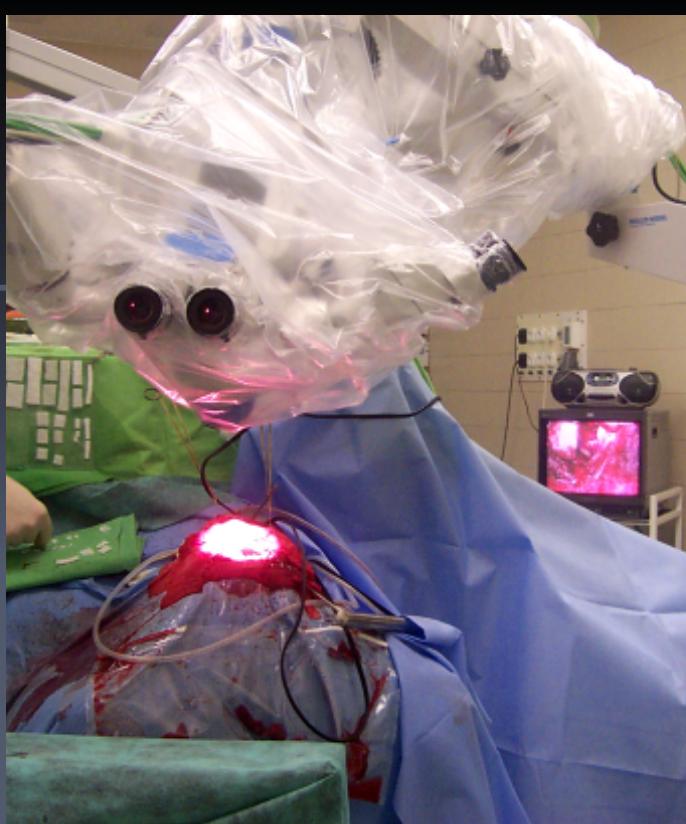
- Microneurosurgery
  - Neuronavigation
  - Intraoperative imaging  
(intraop US, CT, MR)
- 
- Intraoperative monitoring
  - Awake craniotomy

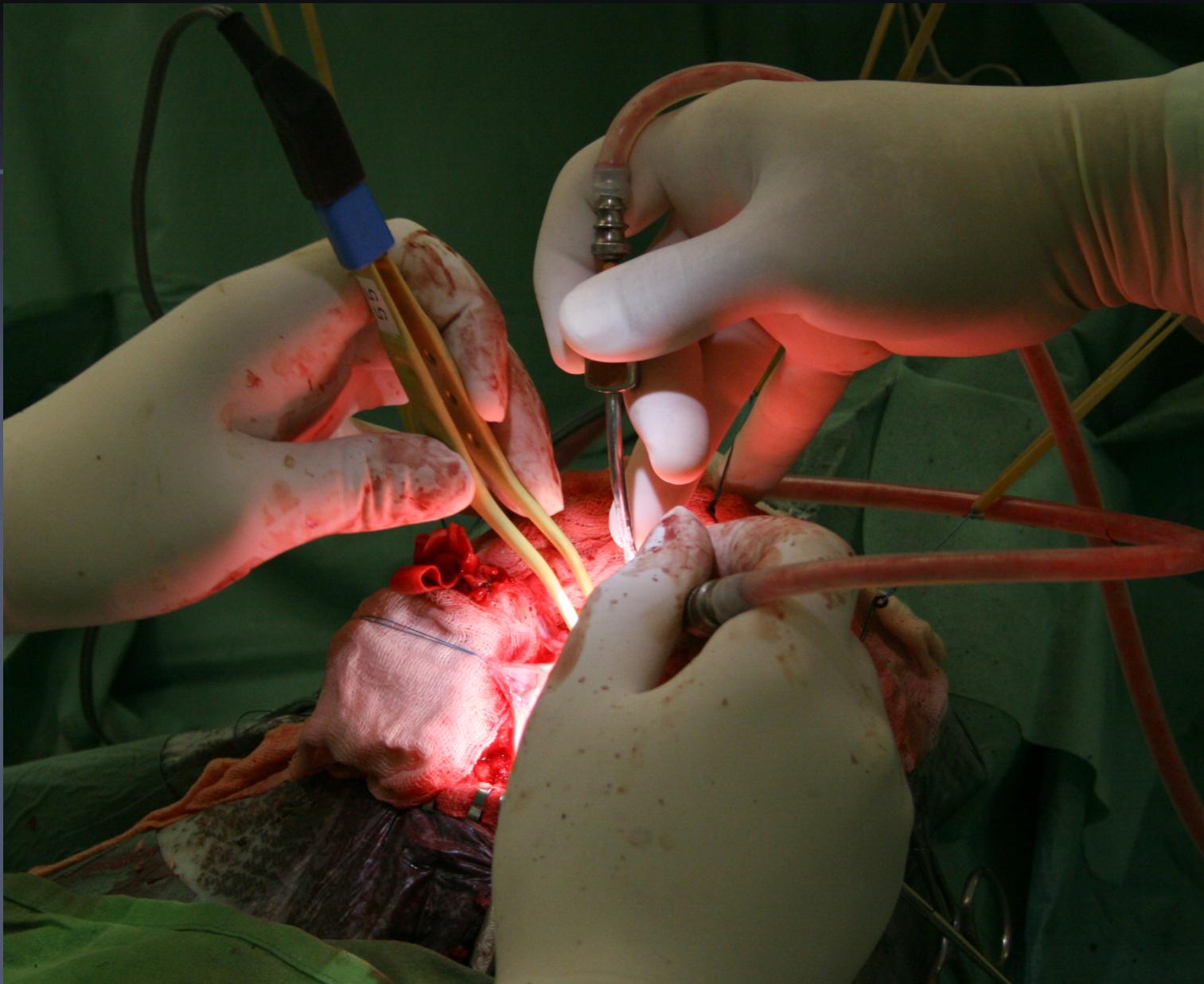


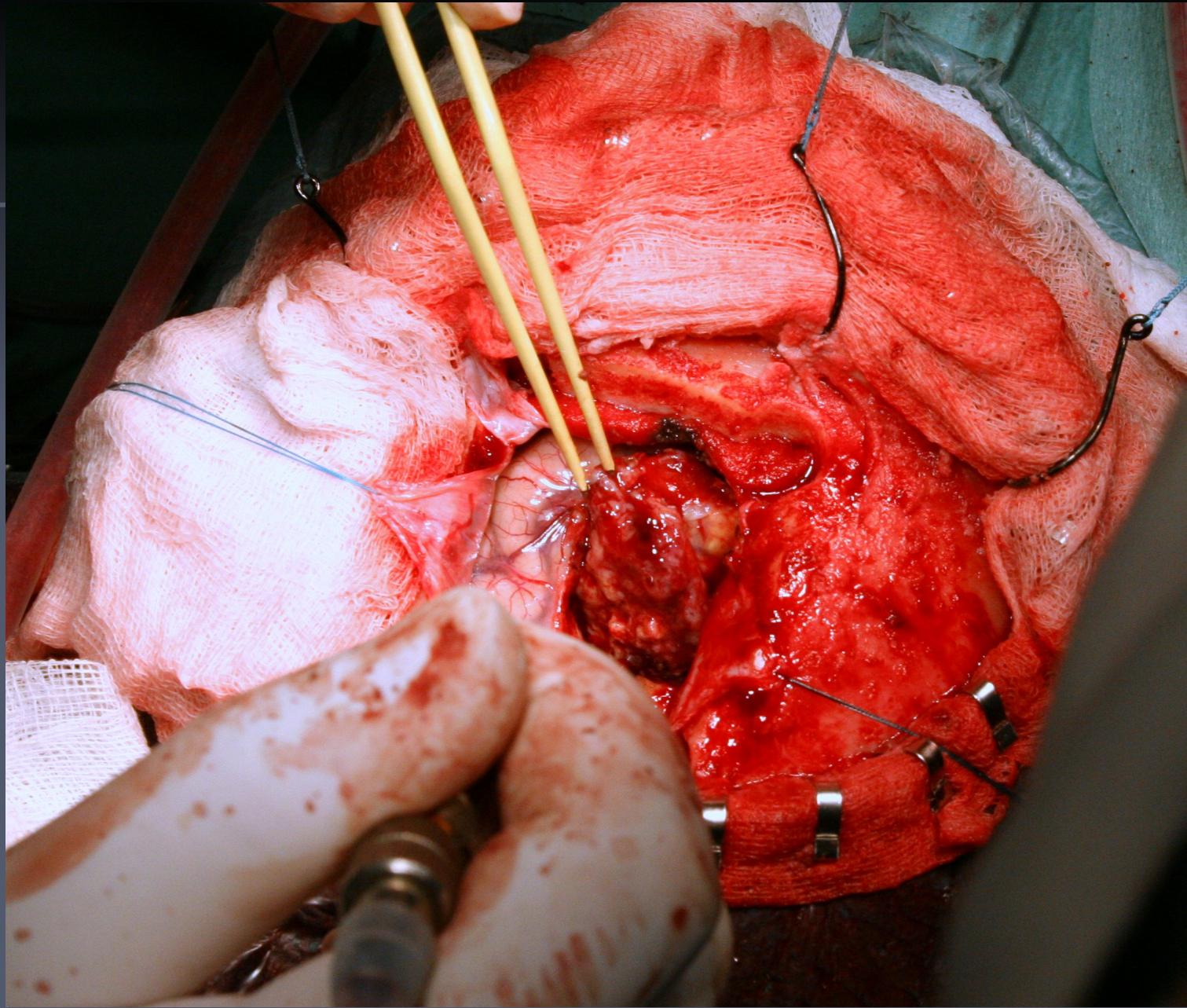
# Micro-neurosurgery

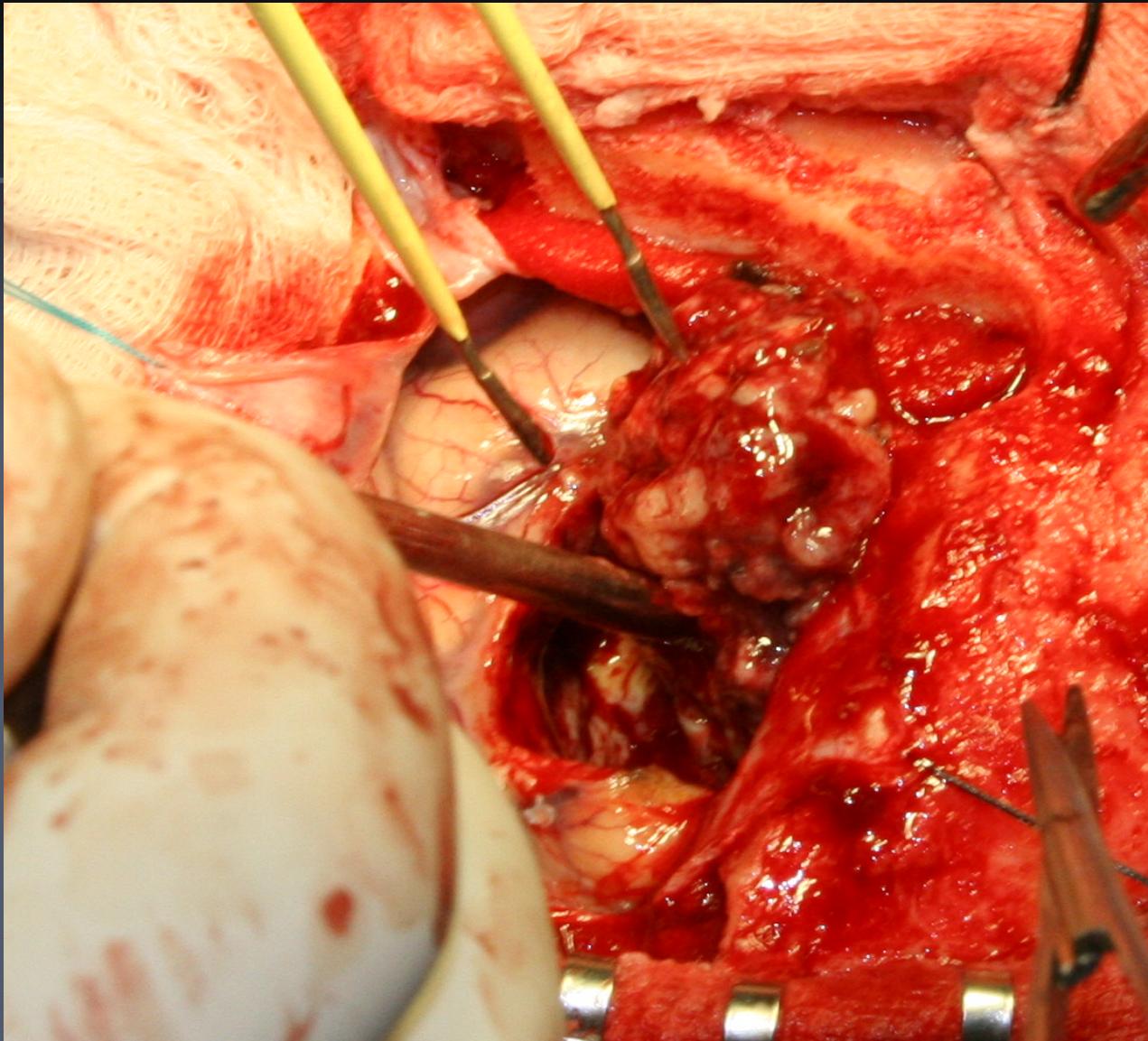




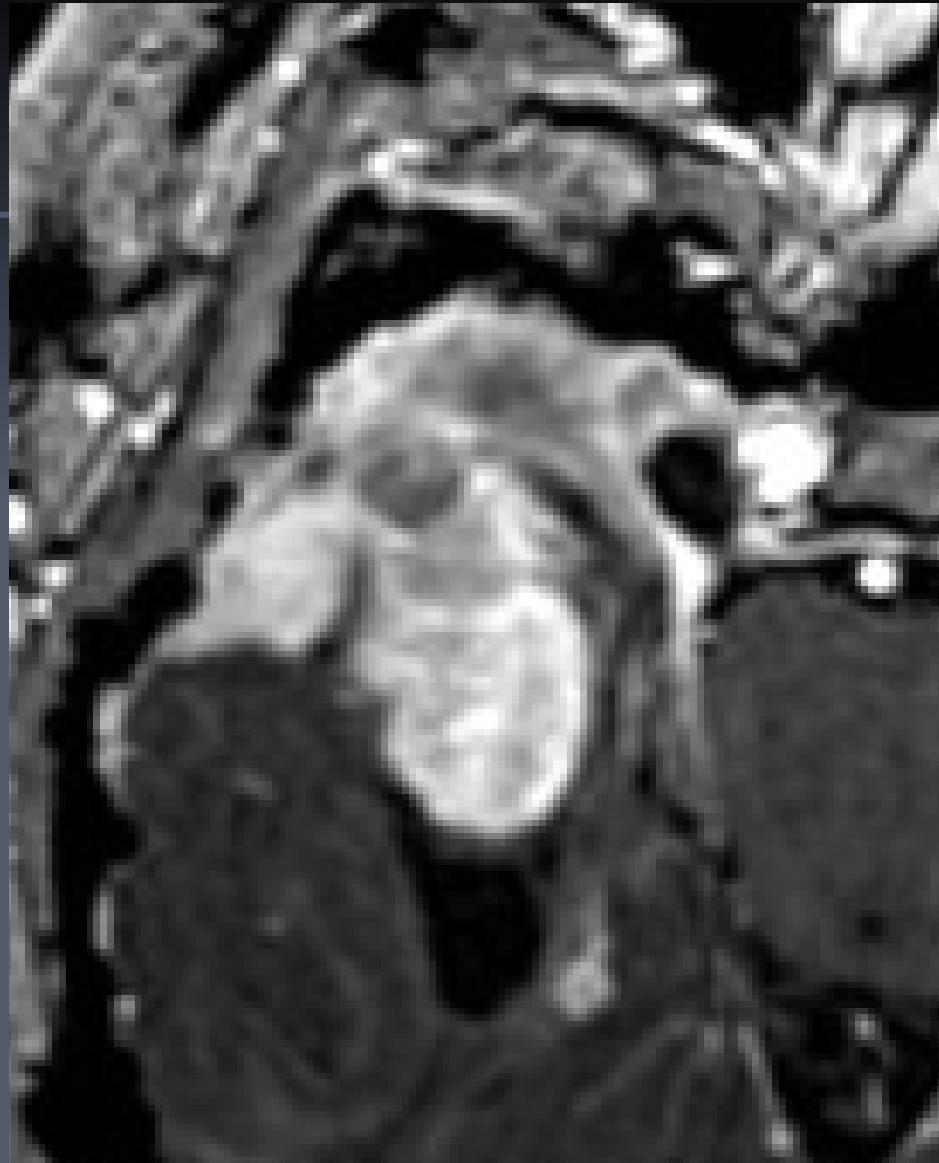
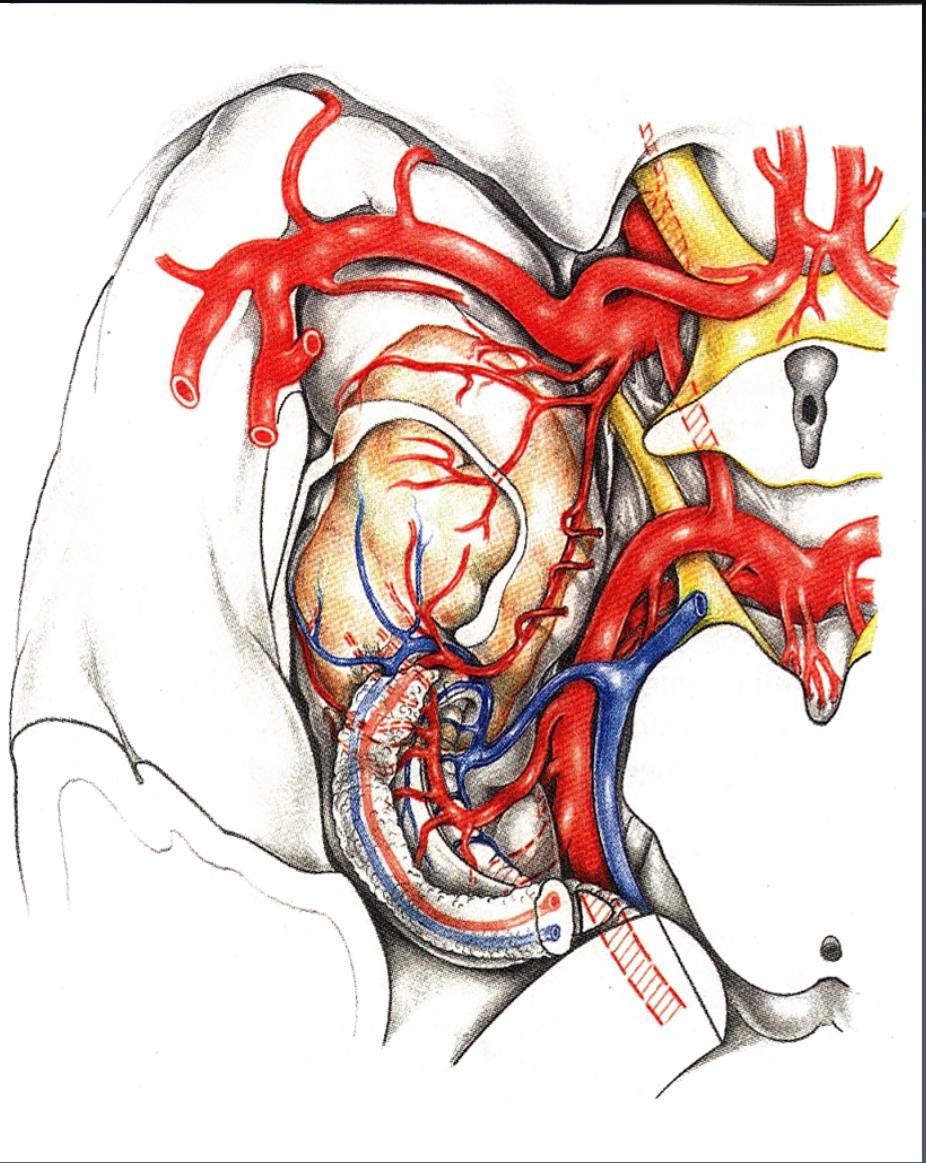


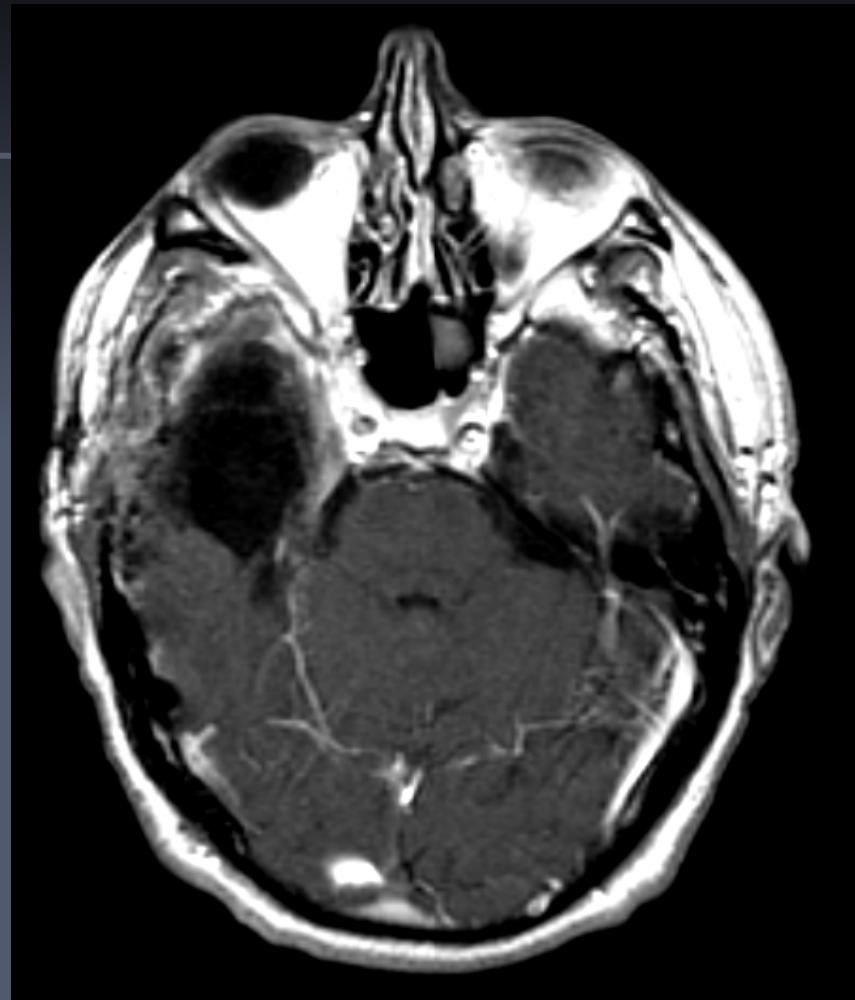
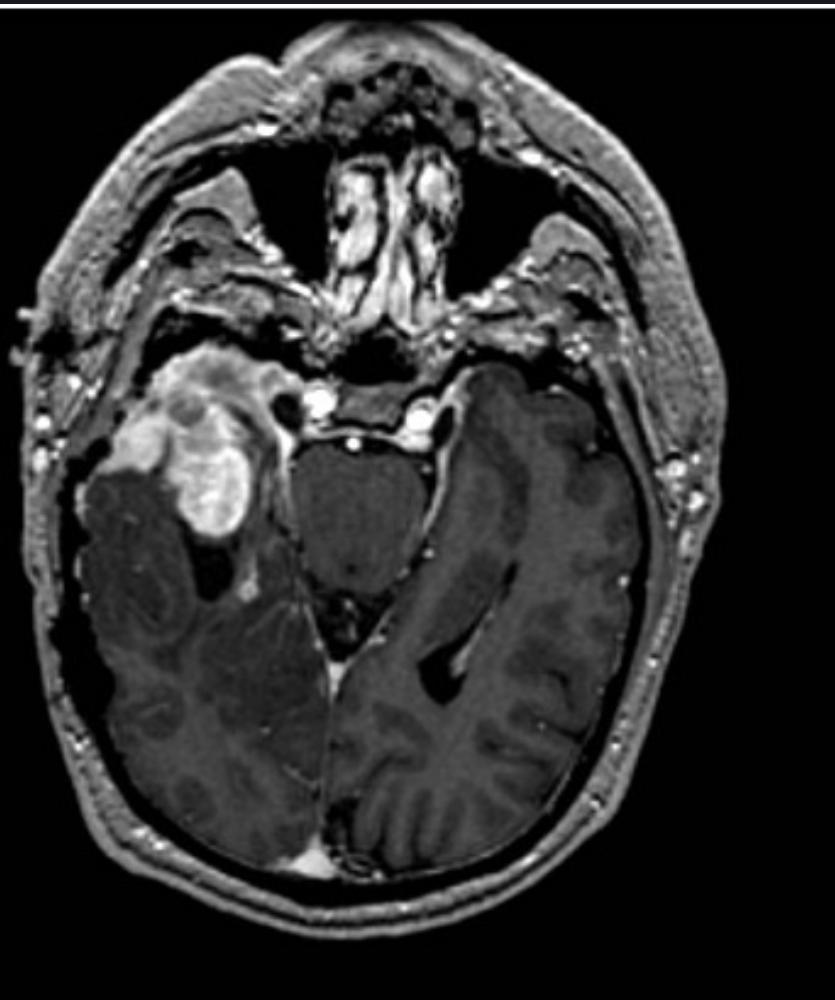


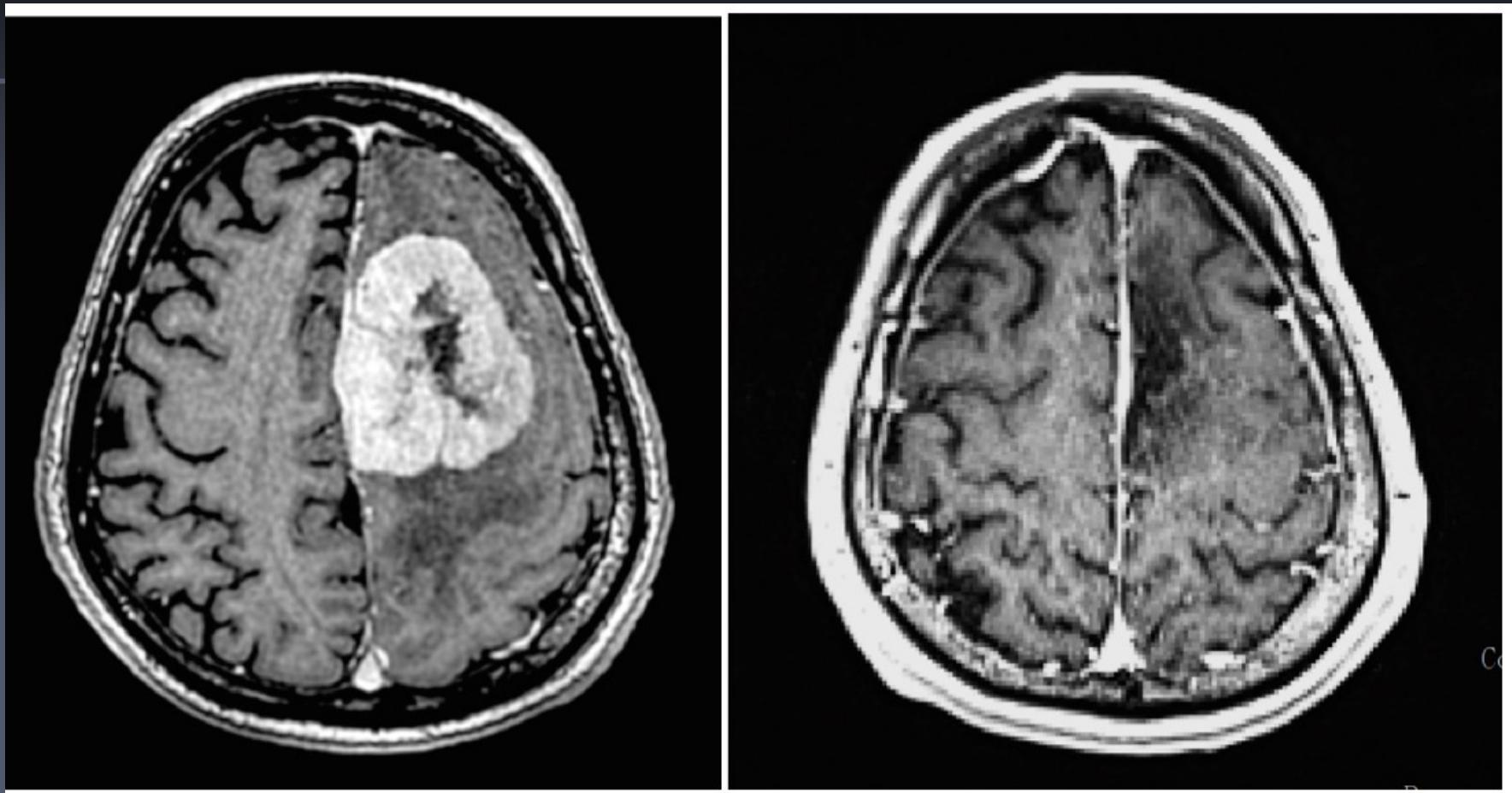












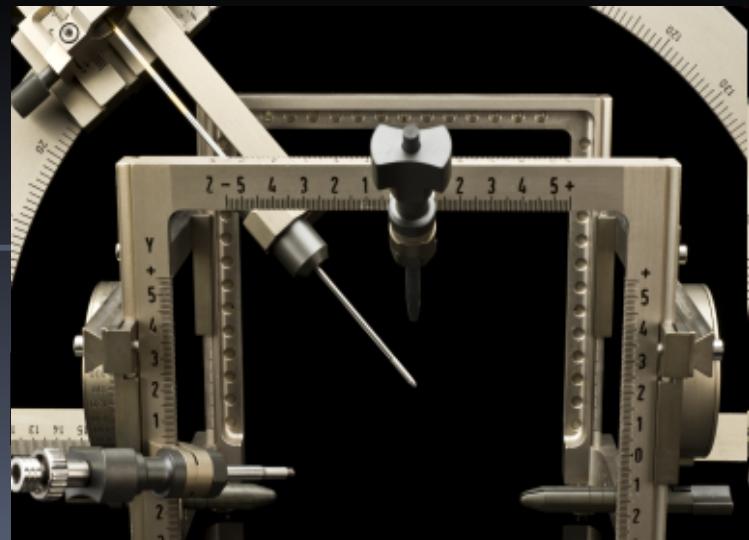
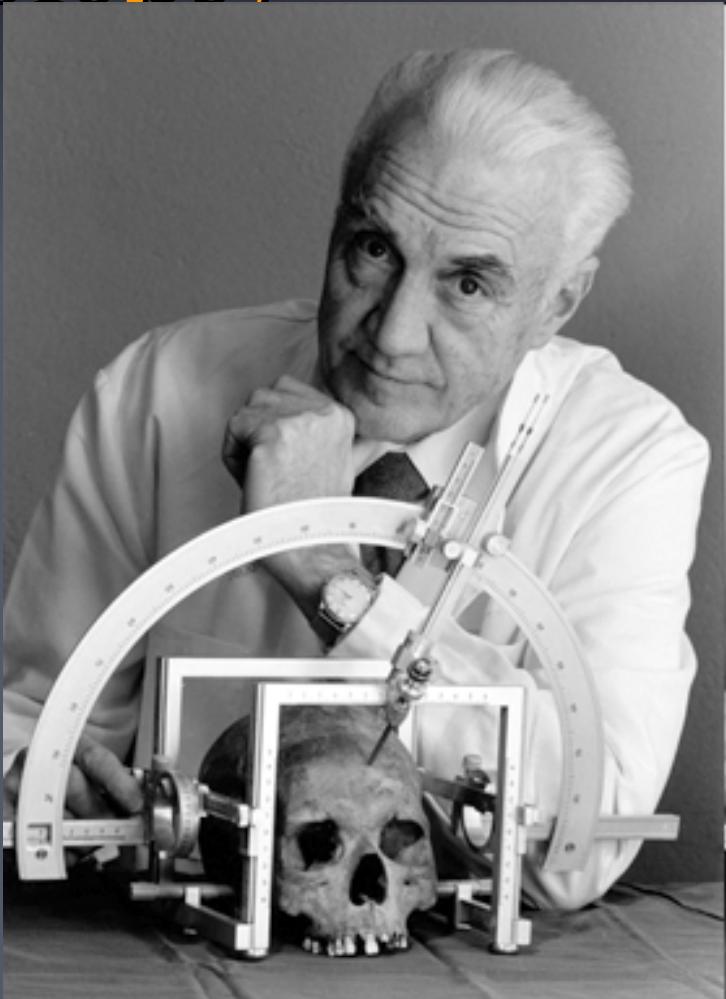


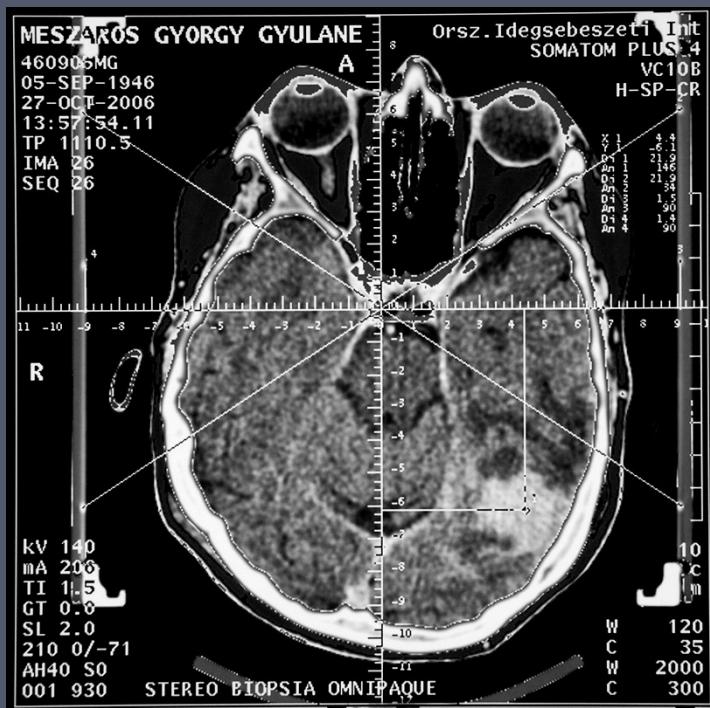
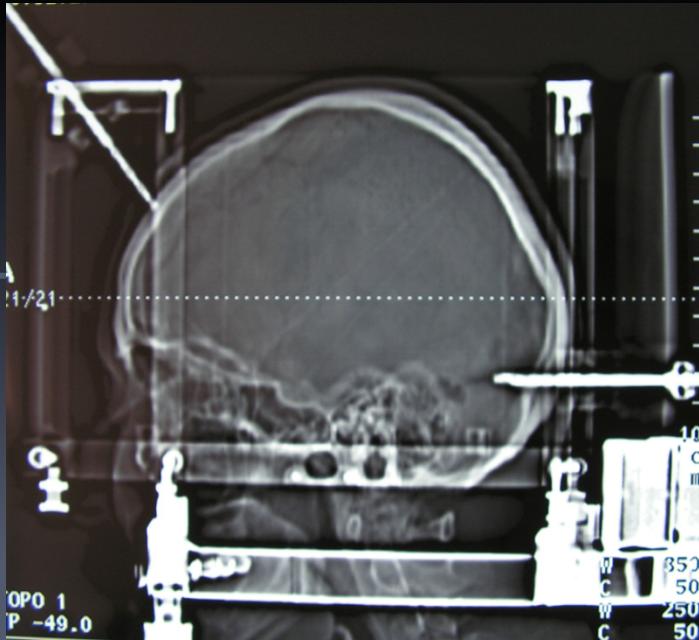
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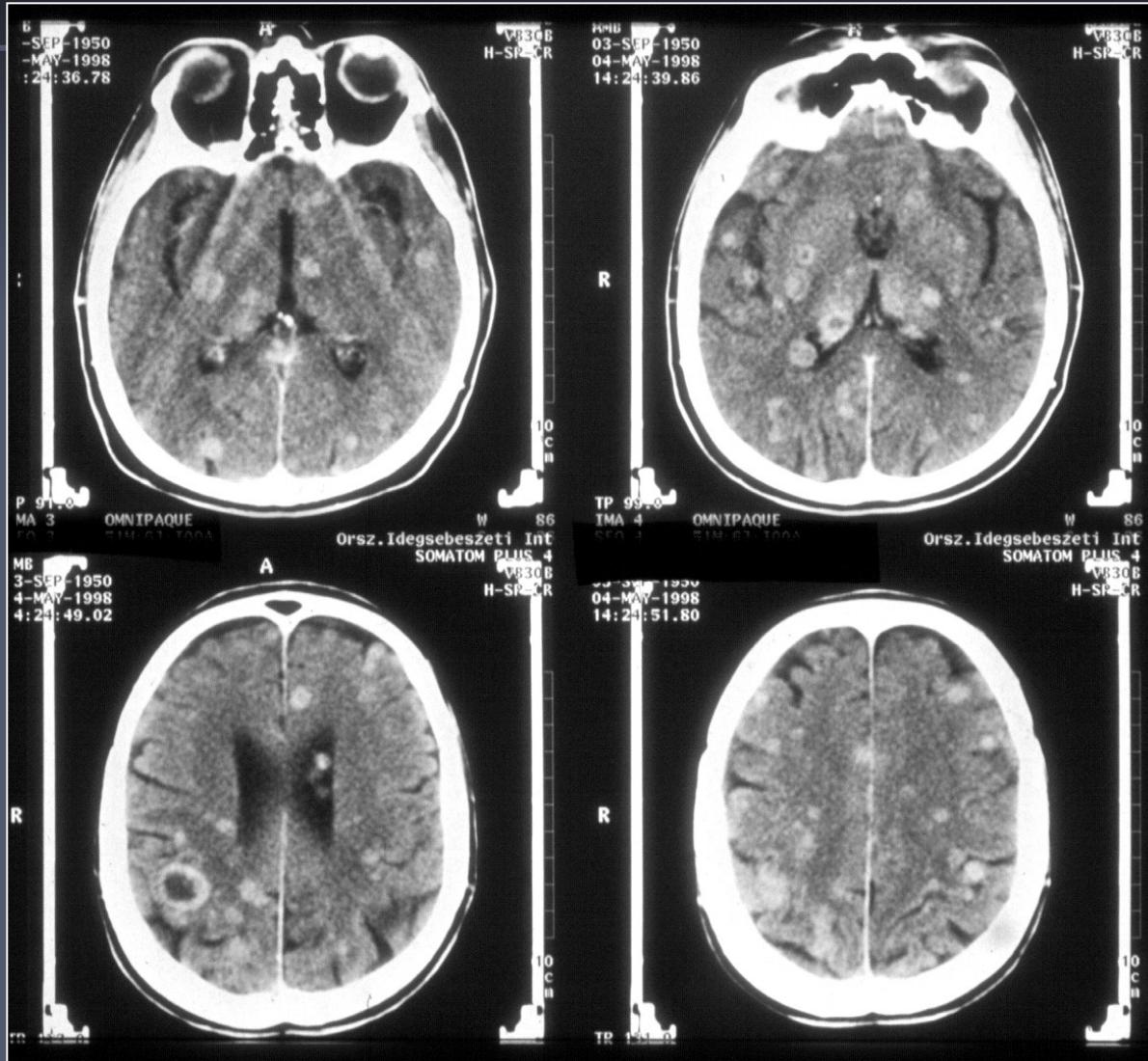


# Stereotactic biopsy





# Multiple metastases

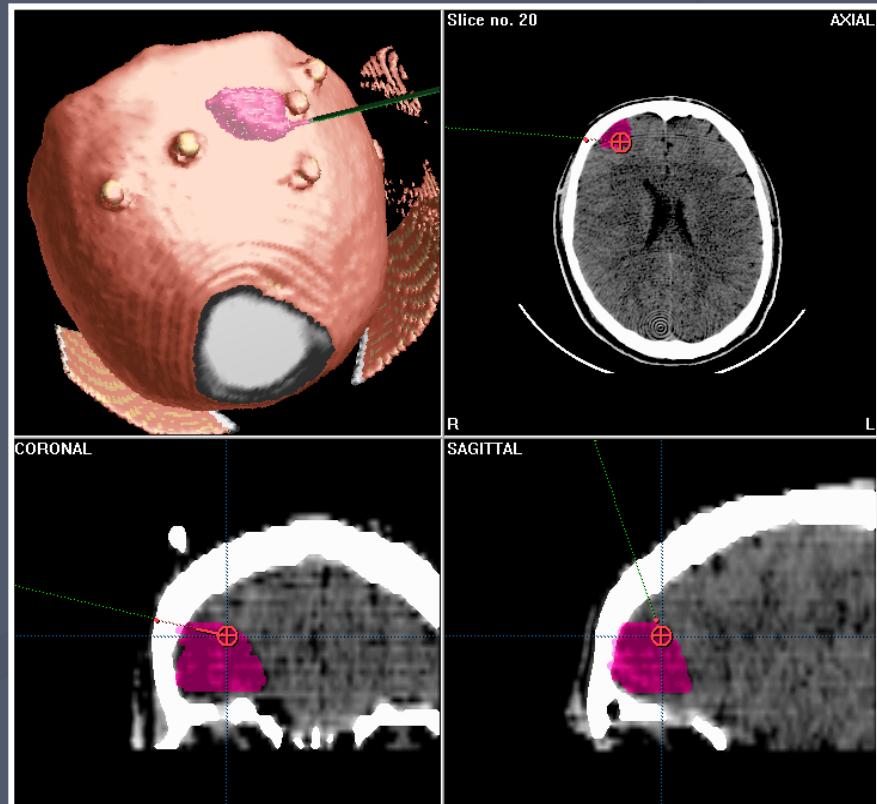
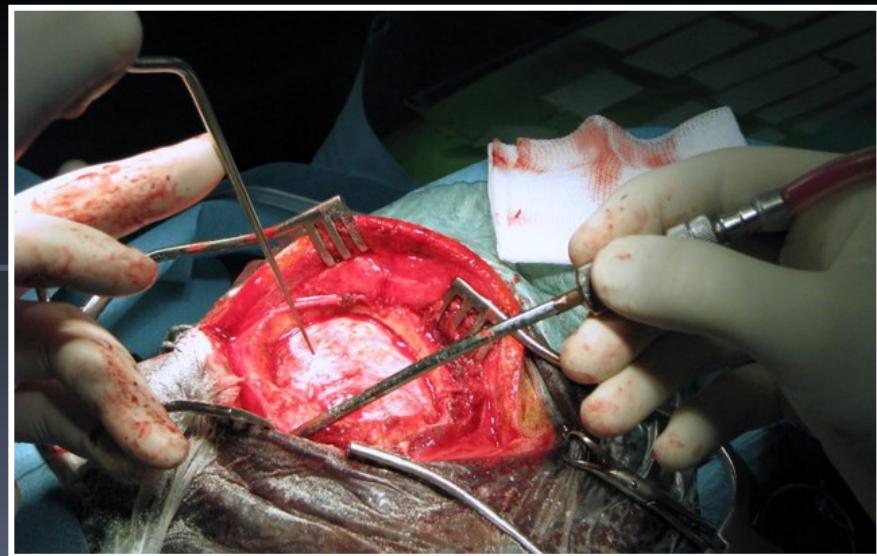
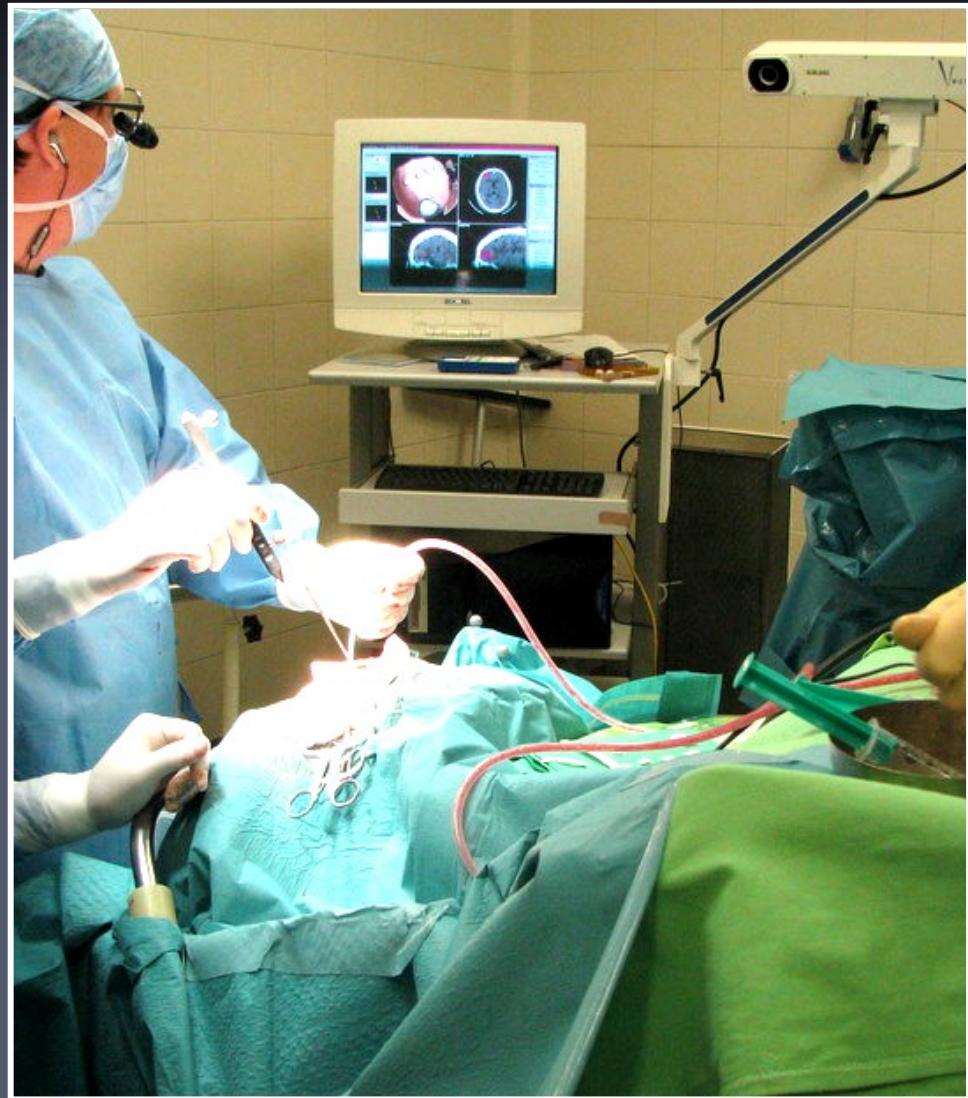


# Neuronavigation

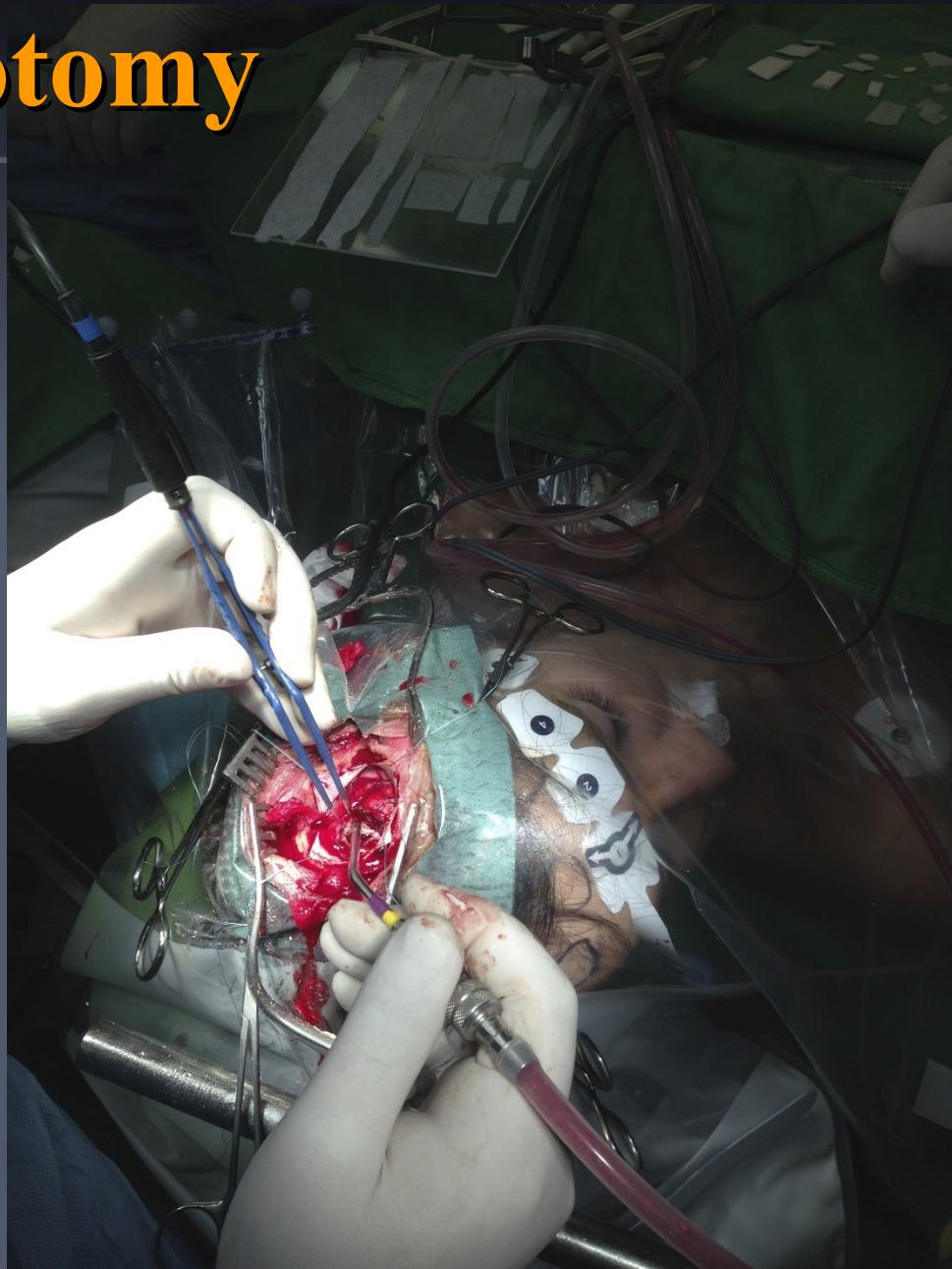


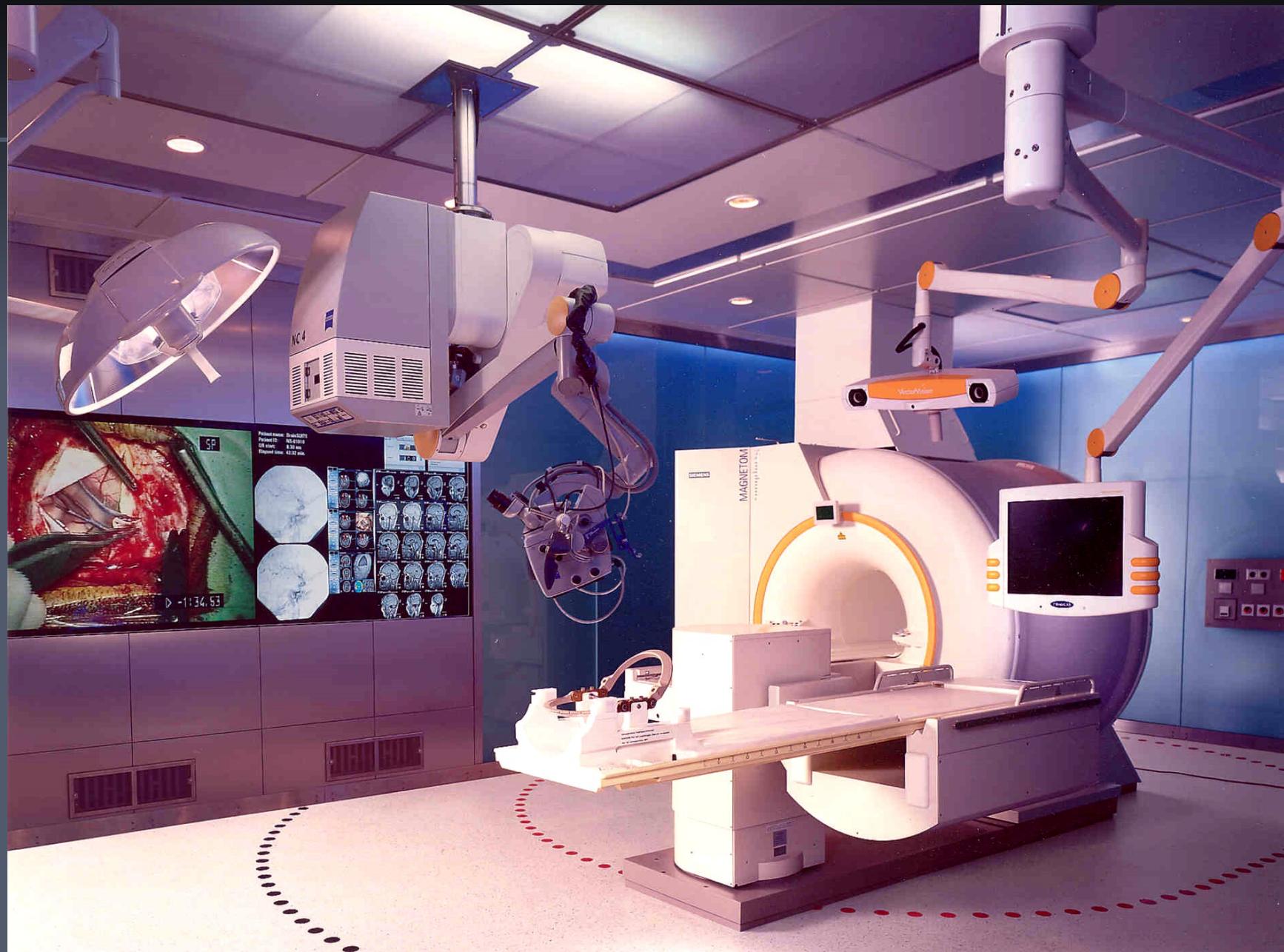
Frameless stereotaxy  
„GPS in the brain“





# Awake craniotomy





# Stereotactic radiosurgery

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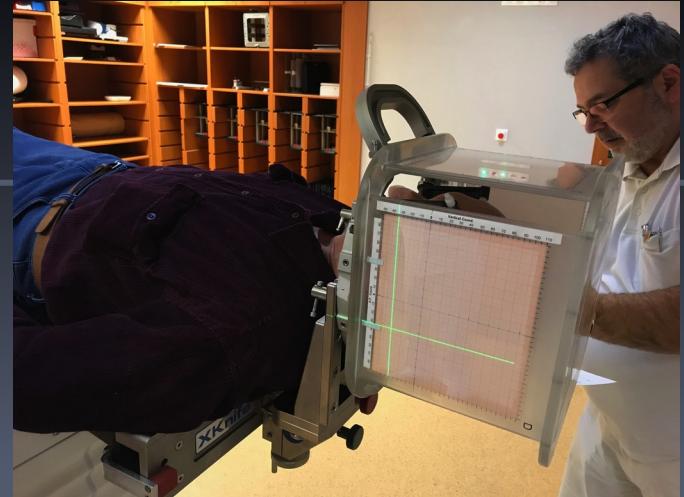
- Focused irradiation
- Targeting: stereotactic frame
- **High dose, in one session** (1200-2000 cGy)
- Out-patient based, minimal morbidity
- Small sized, circumscribed tumors (<3 cm)
- Without craniotomy
- Radiation delivered by LINAC or Gamma Knife

# LINAC – X knife

National Institute of Neurosurgery

National Institute of Oncology

- Most common radiation source
- Different energy (6-23 MeV)
- Rotating radiation source
- Radiation arches
- Since 1992, 180 pts/year



# Gamma-Knife

- 1950's Lars Leksell
- Cobalt source (211 pieces)
- Target in the isocenter (stereotaxy)
- Spheric arrangement
- Collimator helmet

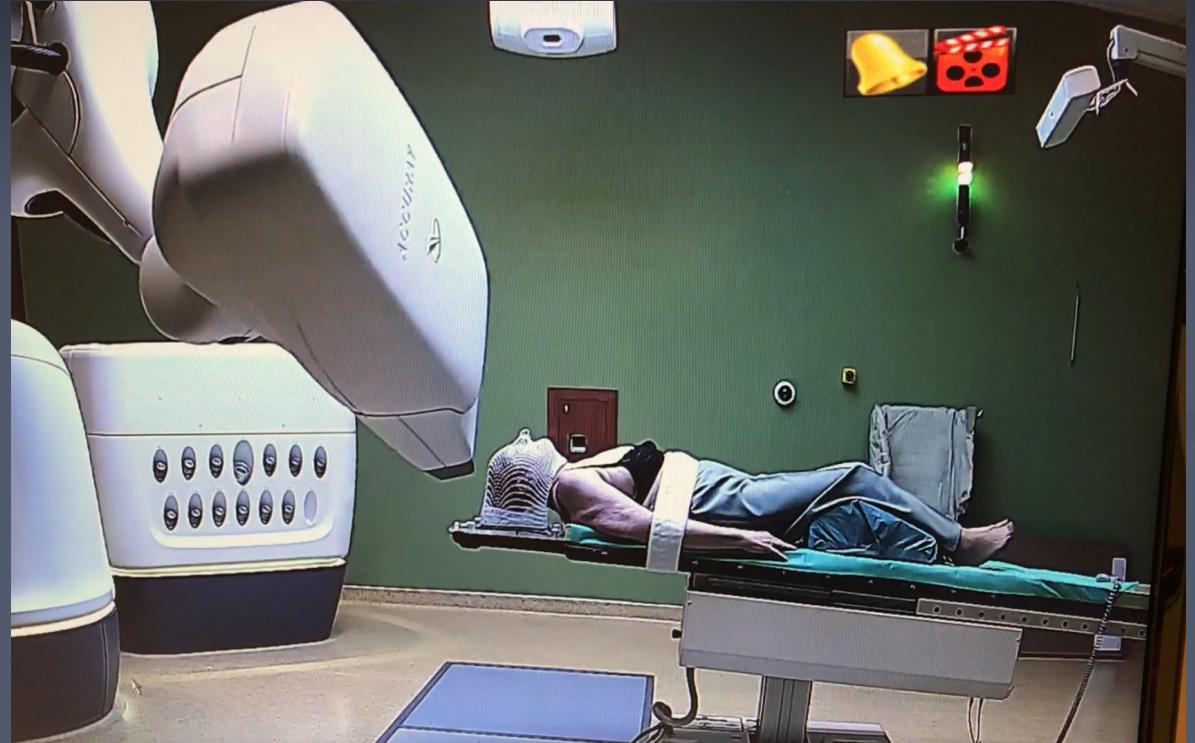


Rotating Gamma  
Debrecen University, 2006



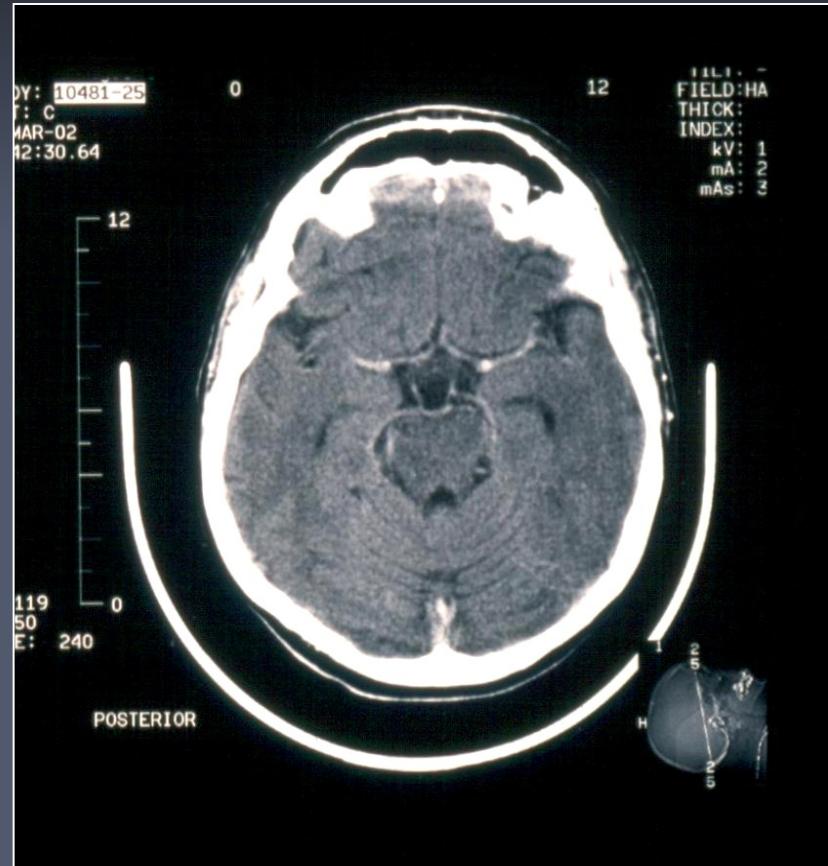
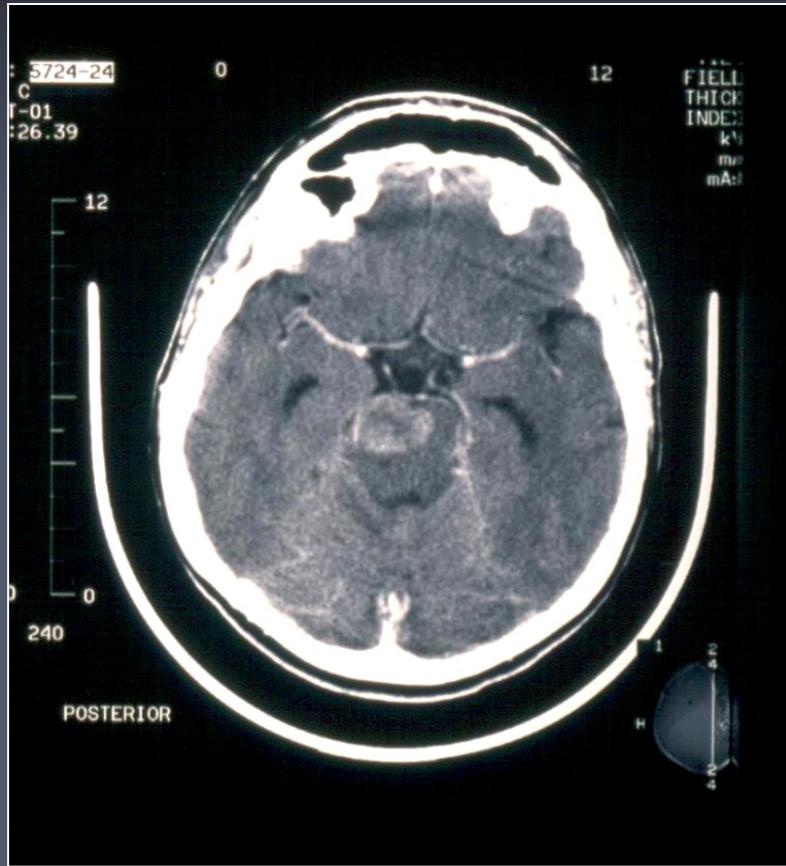
# Cyber-Knife

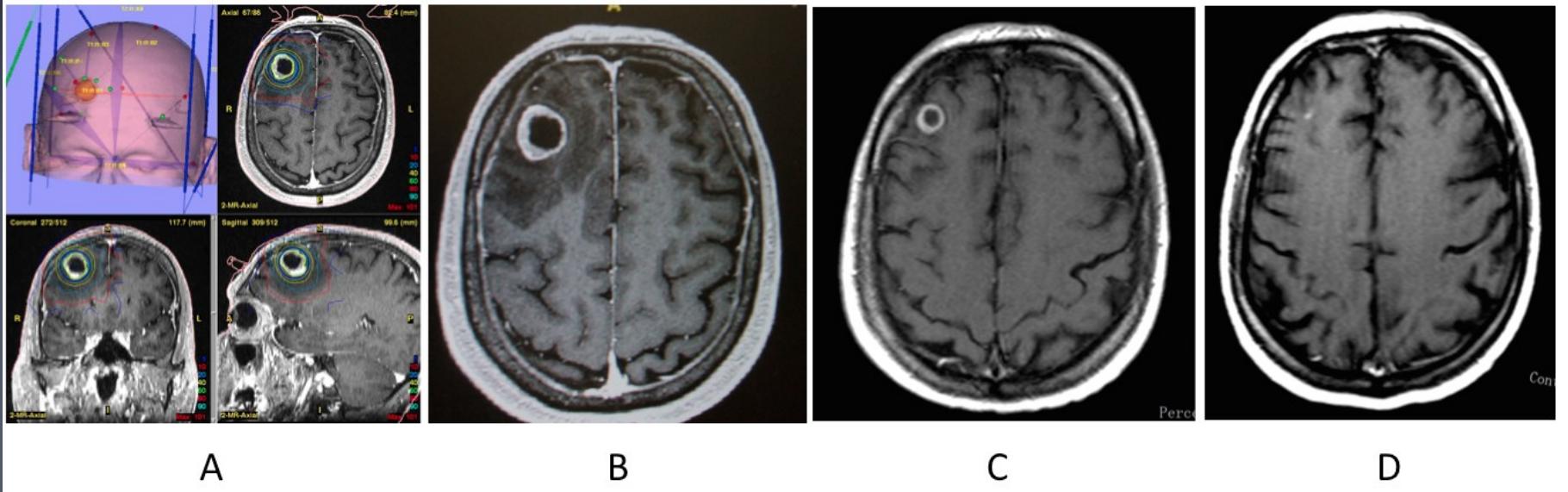
- Robotic arm
- LINAC
- Frameless
- Fractionation
- Big targets

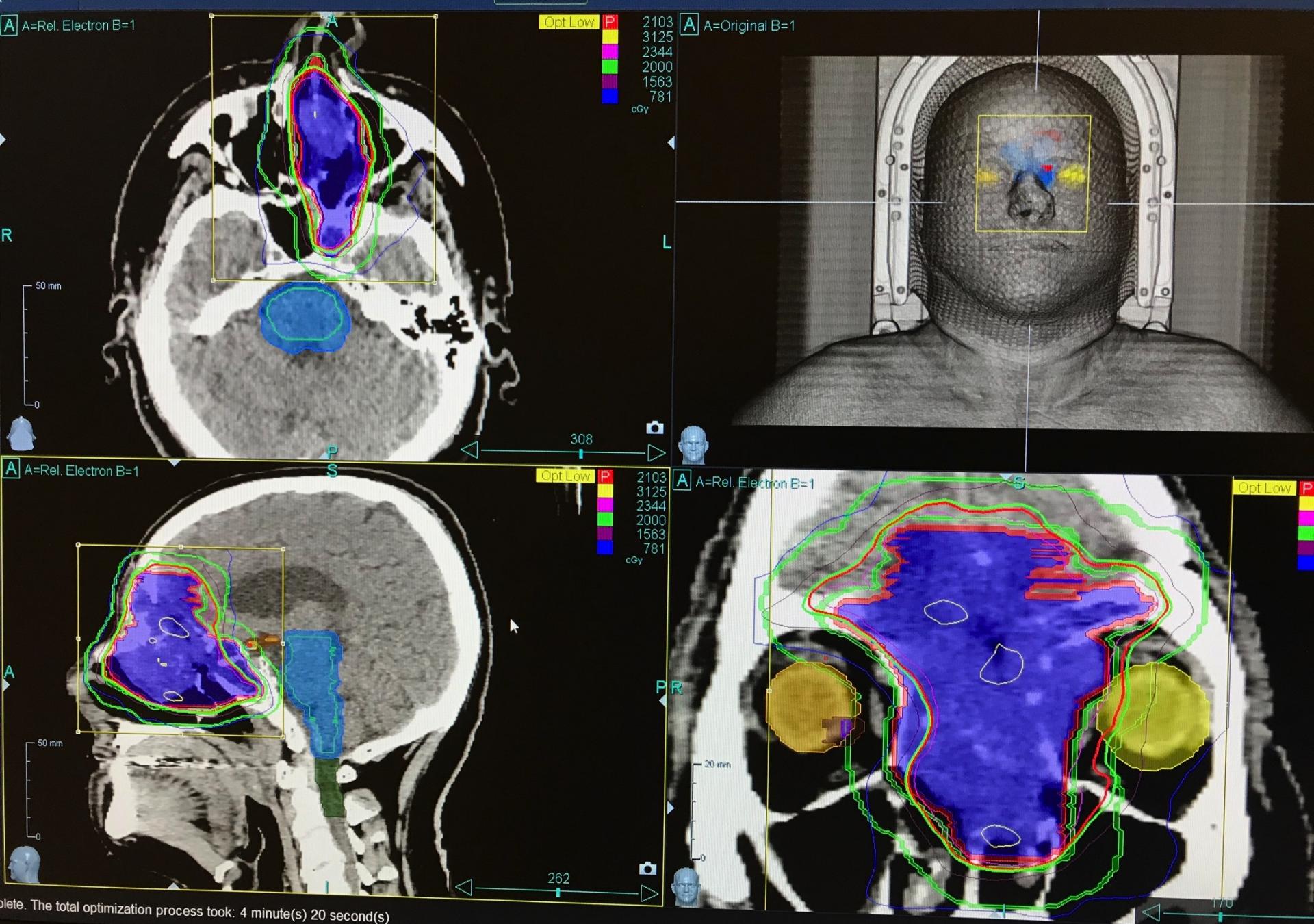


Natl. Inst of Oncology, 2017

# Radiosurgery – pontine met







# Radiotherapy



- Fractionated – low dose, multiple sessions
- Postoperative / palliation
- Malignant glioma – conformal 25-30x200 cGy
- Metastases – whole brain 10x300 cGy
- Radiation oncology center
- Cobalt source or LINAC

# **Chemotherapy**

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- Blood-brain-barrier
- Mets – chemotx according to the primary tu
- Primary brain tumors ar less chemosenistive
- Oligodendrogliomas – PCV
- Lymphoma – MTX
- New: Temozolomide – malignant glioma

# Temozolomid chemoradiation followed by temozolomid monox

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**Stupp regimen – gold standard in GBM**

(R. Stupp et al, 2005, N Eng J Med)

- 6000/200 cGy konformal radiotherapy
- Every day during RTX 75mg/m<sup>2</sup>  
temozolomide per os
- Followed cyclic temozolomide 200mg/m<sup>2</sup>  
5/28 d cycles
- For 6 months – now until progression

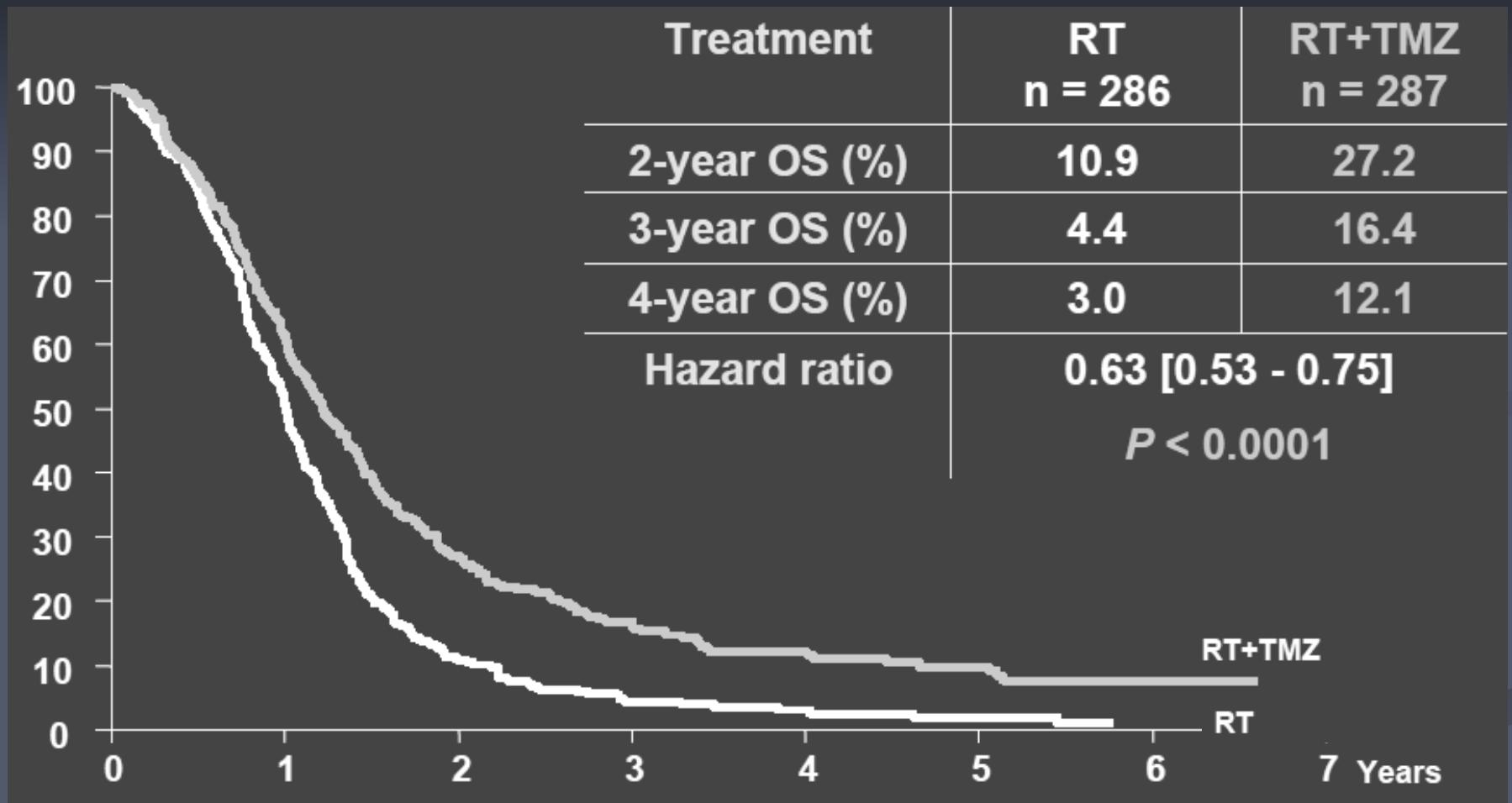
# EORTC 26982/22982-NCIC-CE 3 phase III randomized study 573 pts

## Radiotherapy plus Concomitant and Adjuvant Temozolomide for Glioblastoma

Roger Stupp, M.D., Warren P. Mason, M.D., Martin J. van den Bent, M.D.,  
Michael Weller, M.D., Barbara Fisher, M.D., Martin J.B. Taphoorn, M.D.,  
Karl Belanger, M.D., Alba A. Brandes, M.D., Christine Marosi, M.D.,  
Ulrich Bogdahn, M.D., Jürgen Curschmann, M.D., Robert C. Janzer, M.D.,  
Samuel K. Ludwin, M.D., Thierry Gorlia, M.Sc., Anouk Allgeier, Ph.D.,  
Denis Lacombe, M.D., J. Gregory Cairncross, M.D., Elizabeth Eisenhauer, M.D.,  
and René O. Mirimanoff, M.D., for the European Organisation for Research  
and Treatment of Cancer Brain Tumor and Radiotherapy Groups and the National  
Cancer Institute of Canada Clinical Trials Group\*

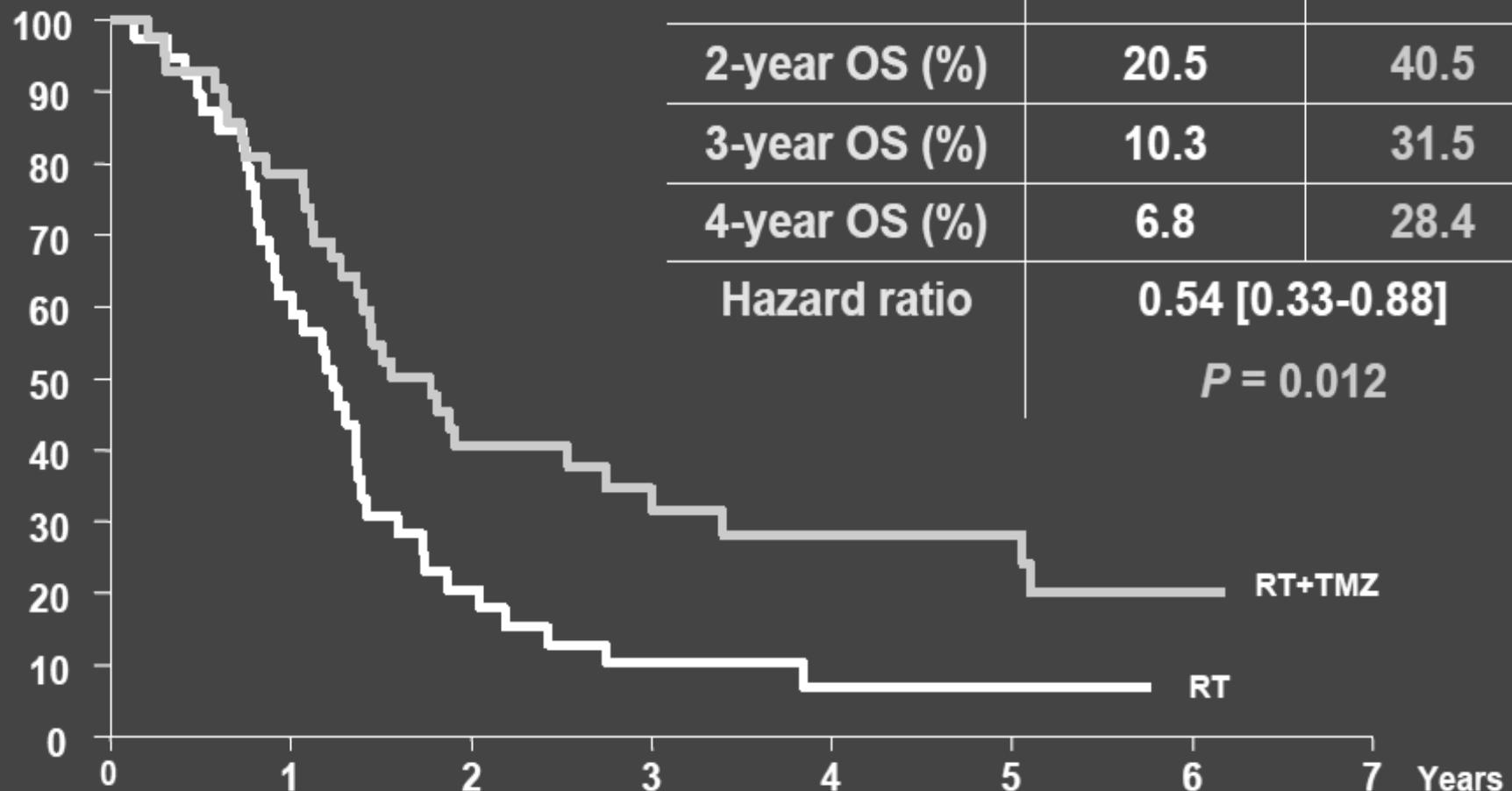
N Engl J Med 2005;352:987-96.

# 2007 update (ASTRO)



# RPA III

Overall survival: Treatment in RPA class 3



# TMZ radiochemotherapy and prolonged TMZ chemotherapy

## **Stupp regimen – gold standard**

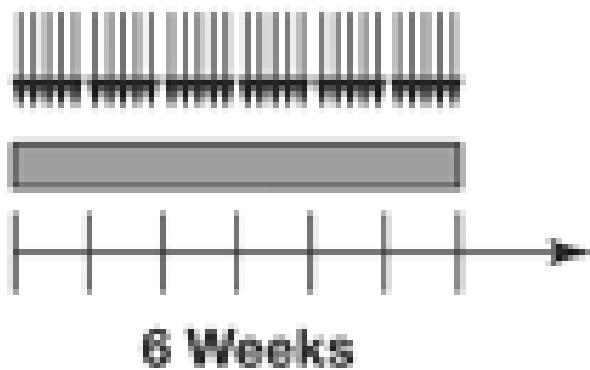
(R. Stupp et al, 2005, N Eng J Med)



- 60/2 Gy conformal radiotx
- TMZ 75mg/m<sup>2</sup>/d temozolomide PO
- 5/28 days cycles @ 200mg/m<sup>2</sup>/d
- 6 cycles (6 months)

(In Hungary for 12-24 months or until progression)

## Concomitant RT + TMZ



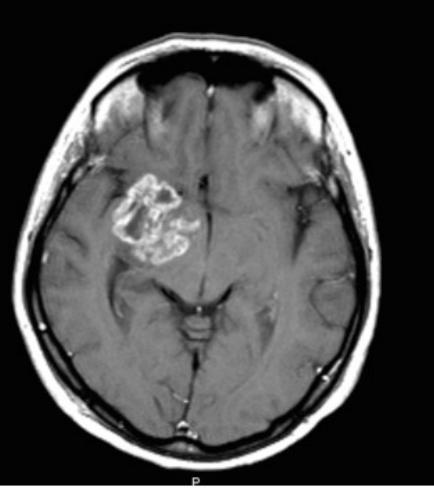
150 to 200 mg/m<sup>2</sup> days 1 to 5 every  
28 days for 12 cycles maximum



TMZ (75 mg/m<sup>2</sup>/day during concomitant phase)



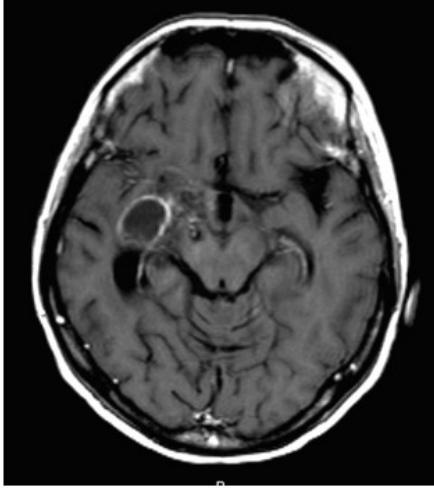
Focal RT daily: 30 × 200 cGy  
Total dose: 60 Gy



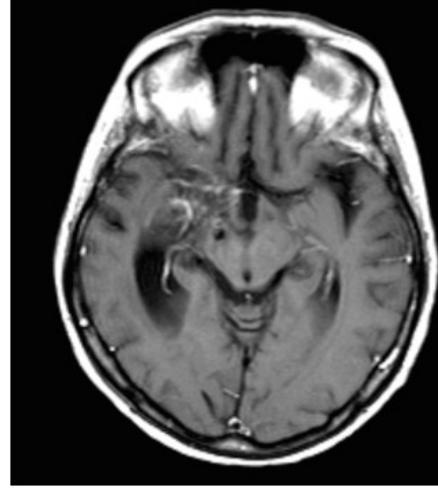
A



B



C



D

# **Neurooncology care**

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- Neurosurgical center
- High patient flow
- Navigation, intraoperative monitoring
- Stereotactic interventions
- Neuropathology
- Close collaboration with an oncology center

**Brain Tumor Center**



# National Institute of Neurosurgery





Tudományos élet

A társaságról

Linkek

Hírlevél ▶

E-mail:

Feliratkozás

Leiratkozás

Törlés

## A Társaság célja

- a. A Társaság célja, hogy tagjainak szakmai tevékenységét elősegítse. Kezdeményezze a betegségcsoporttal kapcsolatos kutatásokat, összehangolja a terápiás törekvéseket, nemzetközi kapcsolatokat teremtsen, segítse elő a neuro-onkológia egyetemi, posztgraduális és szakorvosi oktatását.
- b. A Társaság feladatának tekinti továbbá, hogy a szakterületén aktívan részt vegyen a közvélemény alakításában, a szakszerű tájékoztatásban a tömegkommunikáció felhasználásával.
- c. Kapcsolatot tart fenn a többi magyarországi társszakmát képviselő társasággal.
- d. Tagjai: neurológosok, klinikai onkológosok, onkokardiológusok, idegsebészek, neuroradiológusok, neuropathológusok, neuropsichológusok, neurogenetikusok és egyéb társszakmák képviselői.

# MESSAGE

- Active therapy needed
- Multimodal treatment - Center
  - Microneurosurgery
  - Radiosurgery
  - Radiotx and chemotx
- Onco-team decisions
- Patient F/U and care





**Thank you!**