



Brain Tumors

Neurosurgery

BIO 389

**Caroline Happold / Dorothee Gramatzki
Department of Neurology**

Brain tumors - Neurosurgery

- Primary method for definitive diagnosis and for treatment of brain tumors



Hieronymus Bosch

Extraction of the stone of madness, 15th century

≠



Brain suite

University of Ulm, Germany, 21st century

Brain tumors - Neurosurgery

J Neurosurg. 1984 Nov;61(5):809-13.

The first primary brain-tumor operation.

Kirkpatrick DB.

Abstract

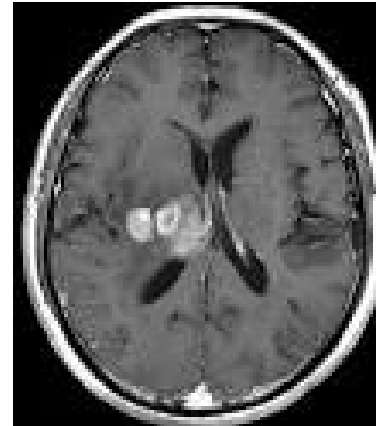
On November 25, 1884, Mr. Rickman J. Godlee performed the first recognized resection of a primary brain tumor. This operation was carried out at the suggestion of Dr. A. Hughes Bennett, a neurologist at The Hospital for Epilepsy and Paralysis, Regents Park, London, England. Other operations for intracranial tumor had been performed but were for extracerebral meningeal or osseous tumors. The "first" operation for a primary cerebral tumor by Godlee was meticulously described and well documented in the medical and popular press of the day and stimulated both professional and lay discussions of the topic that directly and indirectly led to further surgery on the cerebrum itself and the advent of modern neurosurgery. The original patient of Mr. Godlee died on the 28th postoperative day of apparent meningitis and secondary complications, but postmortem examination revealed no remnant of the excised glioma.

Brain tumors - Neurosurgery

- **Goals of neurosurgery:**
 - Tissue sampling for histopathologic diagnosis
 - Cytoreduction/resection of the tumor that will need to be treated with radiotherapy / chemotherapy
 - Reduction of a mass effect
 - Relieve symptoms
 - Decrease pressure on the brain / spinal cord
 - Improving outcome
 - Depending on histology: cure!
- **Indication in brain tumors: virtually always (!)**

Brain tumors - Neurosurgery

- **Extent of neurosurgery:**
 - **Stereotactic biopsy**
 - **Cave: Sampling error!**
 - **Open biopsy**
 - **Partial/gross total/complete resection**



Brain tumors - Neurosurgery

- **Extent of resection ?**
 - Maximize surgical resection vs. avoiding possibly devastating and permanent neurologic complications

- **Negative impact on survival of residual tumor**



- **Postoperative neurological deficits**

Brain tumors - Neurosurgery

Side effects

- **Bleeding**
- **Infection**
- **New neurological deficit**
- **Seizures**
- **CSF leakage**
- **Hydrocephalus**

Brain tumors - Neurosurgery

Intraoperative Resection Control Devices

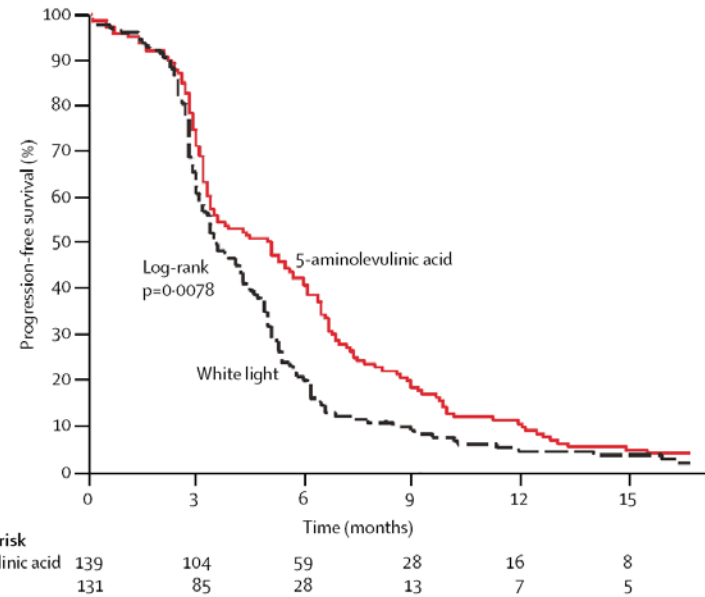
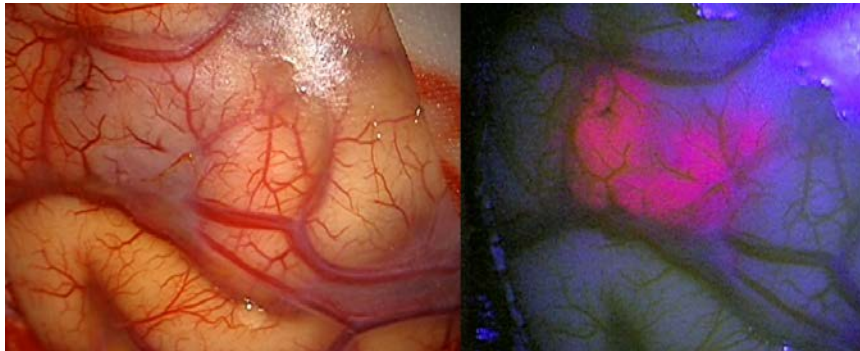
- **Main rationale:**
 - to improve EOR → to extend survival (?)
 - to protect normal/functional brain
- **What`s the evidence?**
 - STUMMER trial (5-ALA RCT)
 - SENFT trial (fh ioMRI RCT)

Brain tumors - Neurosurgery

THE LANCET Oncology

Fluorescence-guided surgery with 5-aminolevulinic acid for resection of malignant glioma: a randomised controlled multicentre phase III trial

Walter Stummer, Uwe Pichlmeier, Thomas Meinel, Otmar Dieter Wiestler, Friedhelm Zanella, Hans-Jürgen Reulen, for the ALA-Glioma Study Group*



5-ALA (Gliolan)

Oral intake -> Accumulation in tumor cells (more than in healthy cells)

- > compound of the porphyrin synthesis pathway
- > precursor of the photosensitizer „protoporphyrin IX“ (red fluorescent)
- > visualize the tumor

Brain tumors - Neurosurgery

THE LANCET Oncology

Intraoperative MRI guidance and extent of resection in glioma surgery: a randomised, controlled trial

Christian Senft, Andrea Bink, Kea Franz, Hartmut Vatter, Thomas Gasser, Volker Seifert

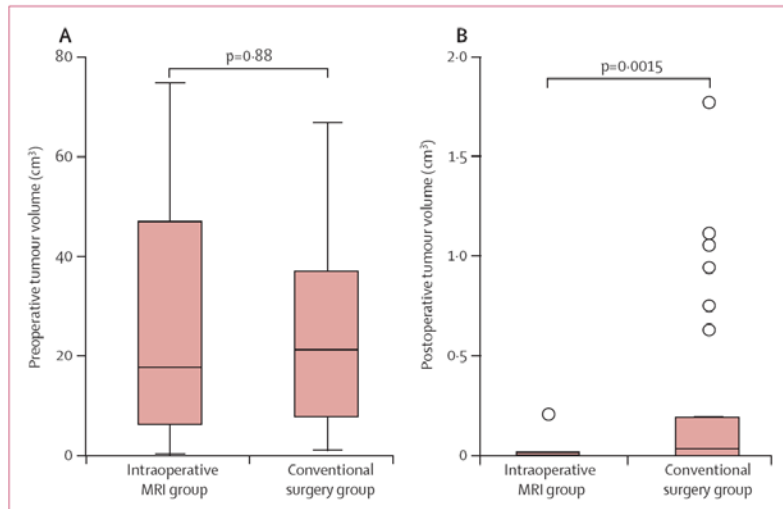
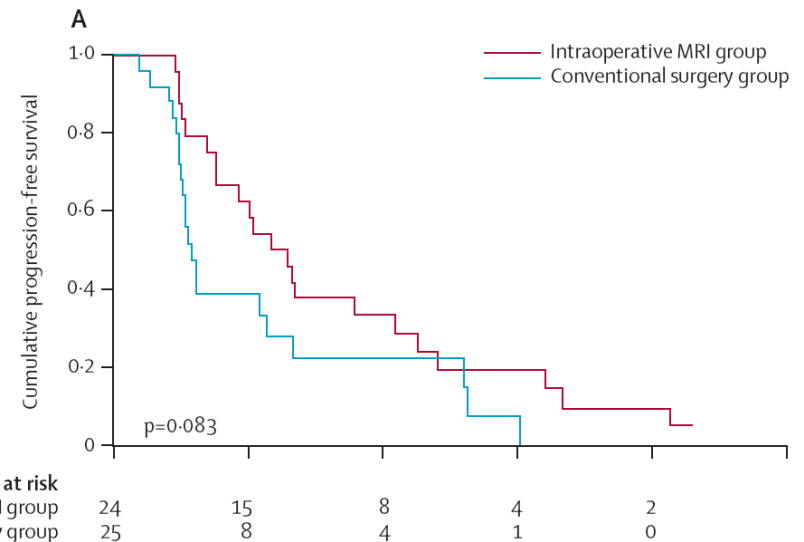


Figure 2: Preoperative and postoperative tumour volumes

Preoperative (A) and postoperative (B). p values were calculated with the Wilcoxon-Mann-Whitney U test.

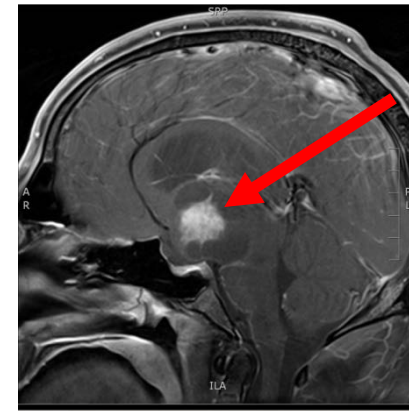
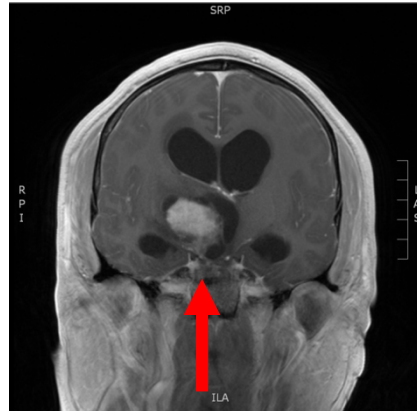
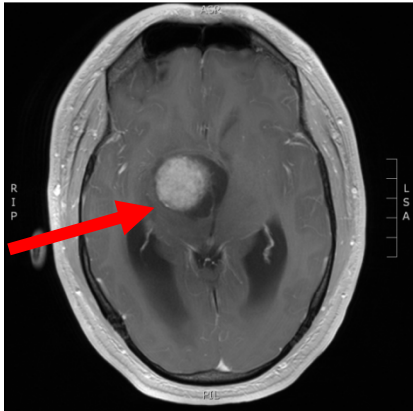


Intraoperative high-field MRI (3T)

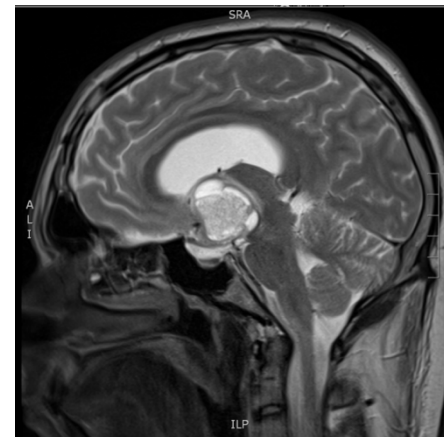
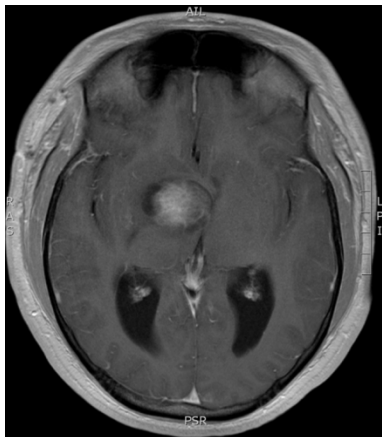
27 yo male, pilocytic astrocytoma

preoperative imaging (outside hospital) 2 years ago

Tumor



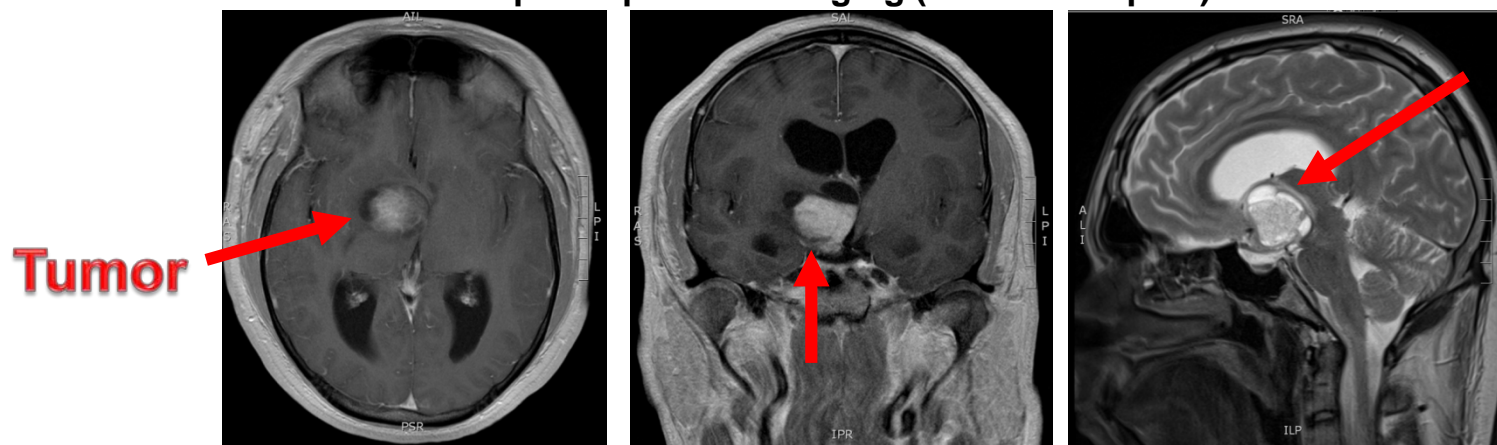
post-operative imaging (outside hospital) 2 years ago



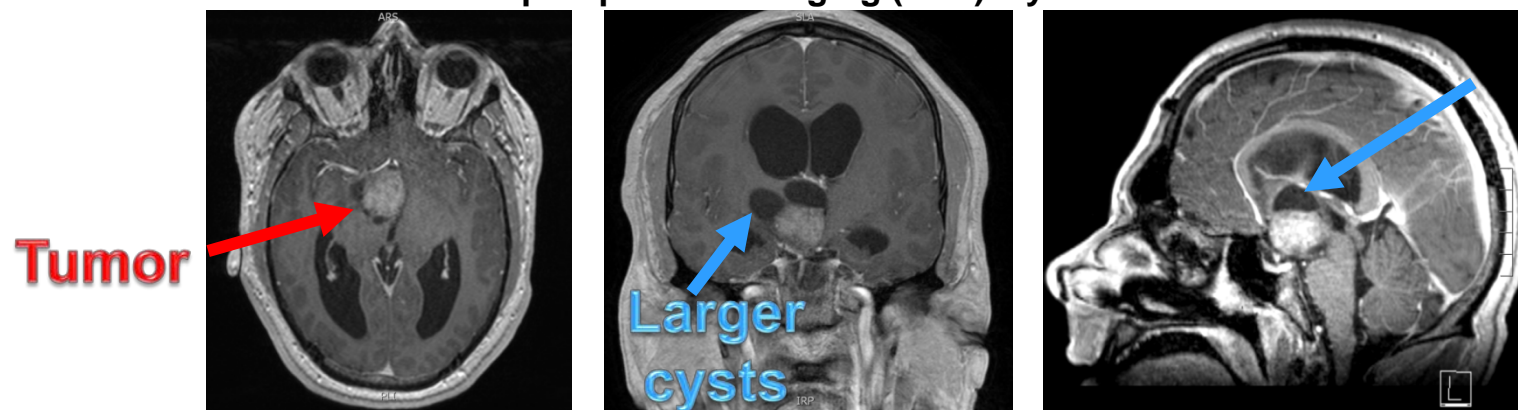
Intraoperative high-field MRI (3T)

27 yo male, pilocytic astrocytoma, chronic headache

post-operative imaging (outside hospital)



preoperative imaging (USZ) 2 years later

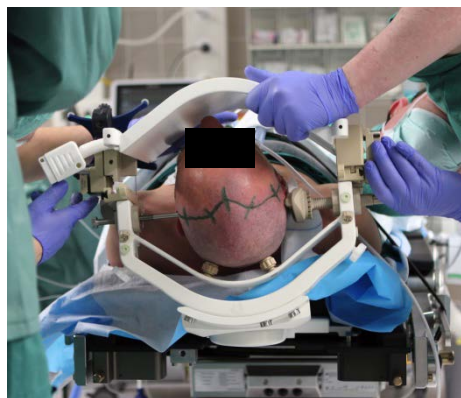
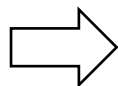


Intraoperative high-field MRI (3T)

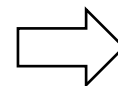
Preparation and surgery



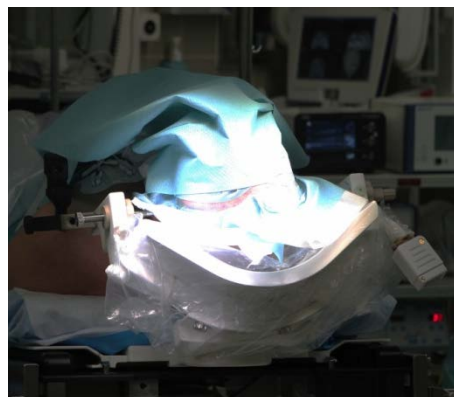
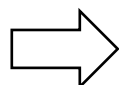
Mayfield fixation



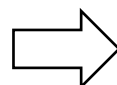
Testing face-to-MRI coil distance



Neuronavigation



Desinfection and sterile covering

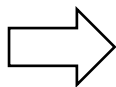


Surgery

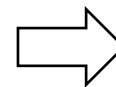
Intraoperative high-field MRI (3T) Transfer to and back from ioMR



Placement of ioMRI coil



OR table positioning



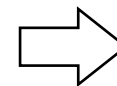
MRI transfer table



3T MRI scan and
data analysis



Transfer back to OR



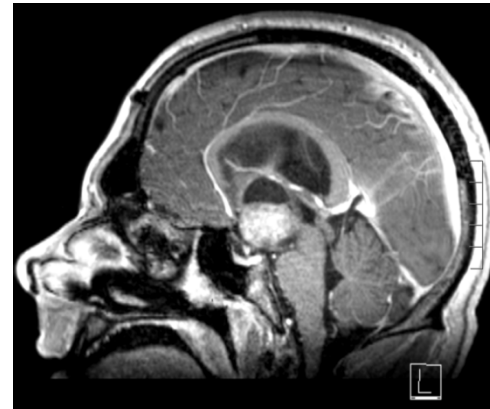
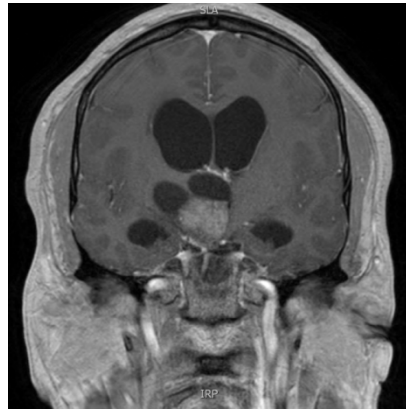
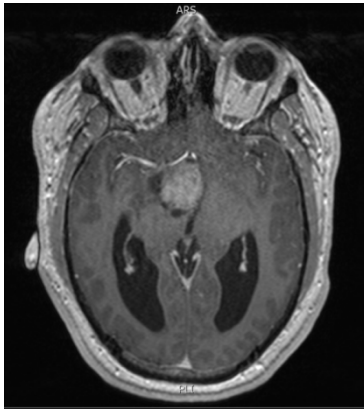
Closure after or without
further resection

All takes about 90 extra minutes

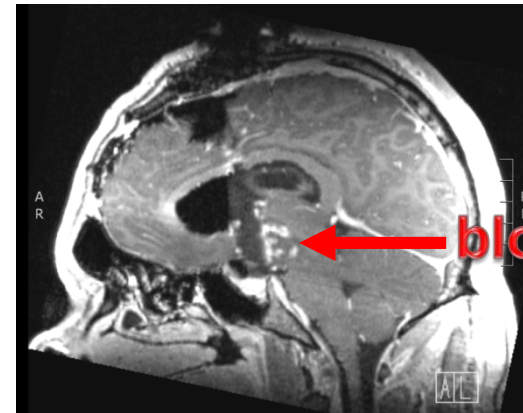
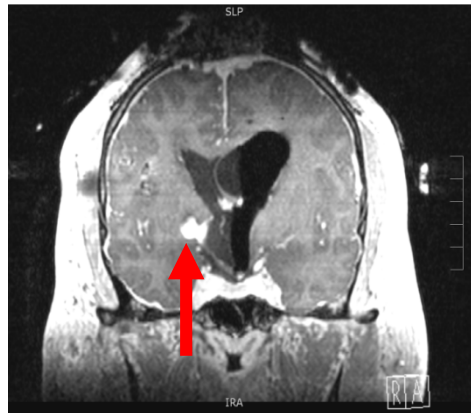
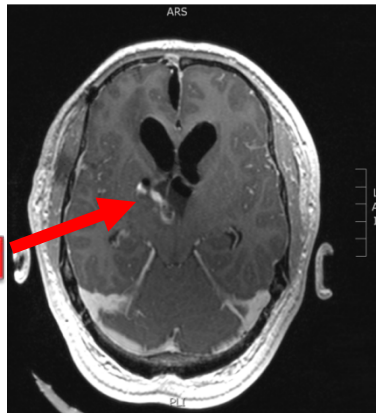
Intraoperative high-field MRI (3T)

27 yo male, pilocytic astrocytoma

preoperative imaging (USZ)



intra-operative imaging 3T MRI (USZ)



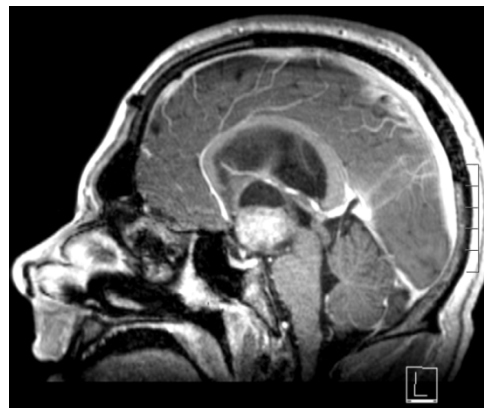
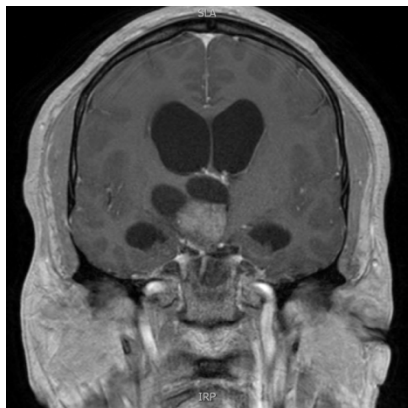
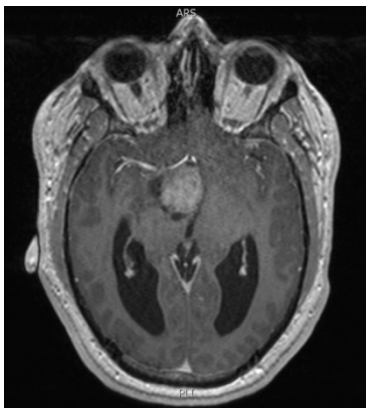
residual
tumor

blood

Intraoperative high-field MRI (3T)

27 yo male, pilocytic astrocytoma

preoperative imaging (USZ)



3 months postop imaging (USZ)

