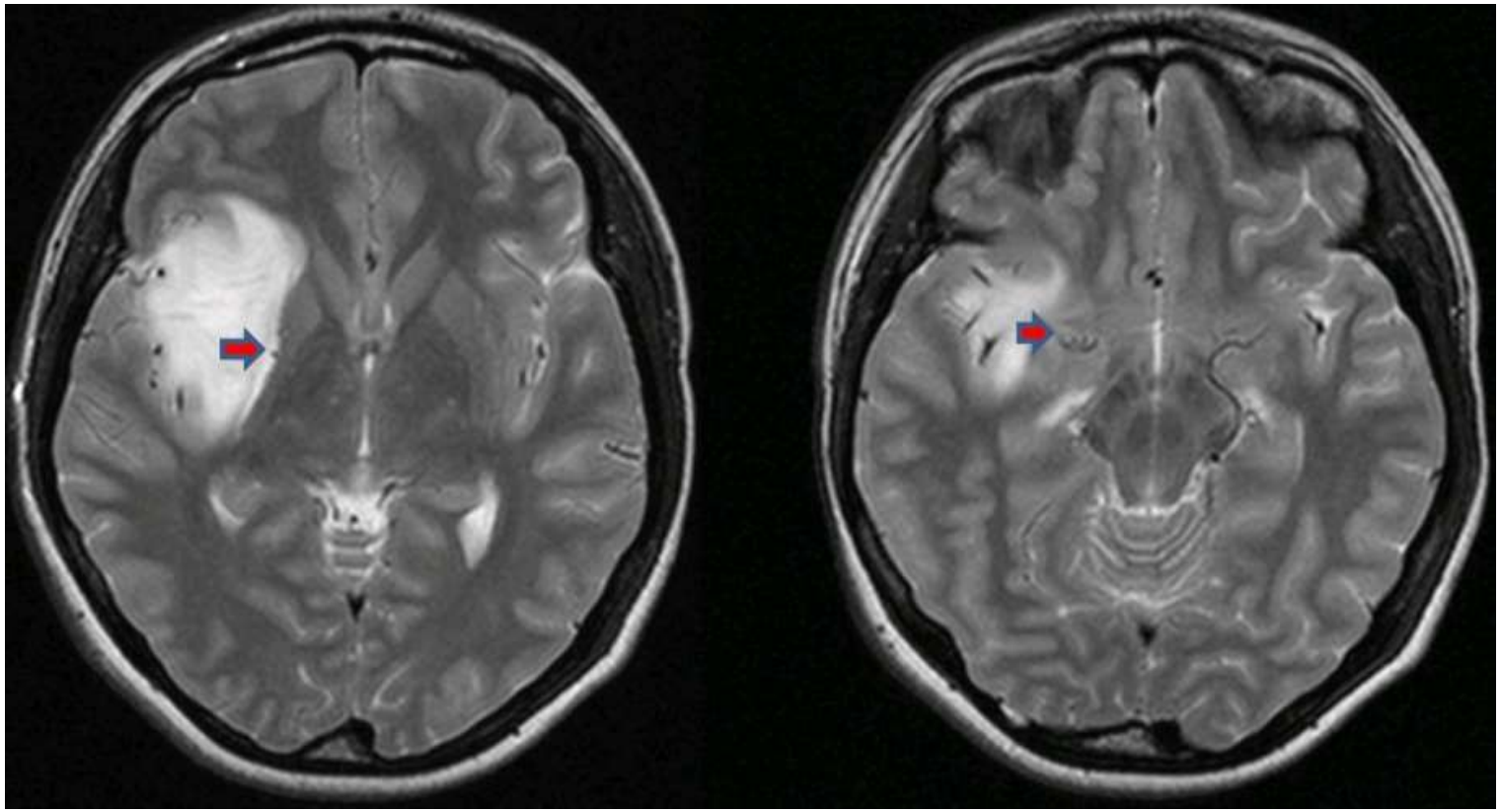
Microsurgical anatomy of insular, hippocampal and cingular tumors surgery

Robert Bartoš

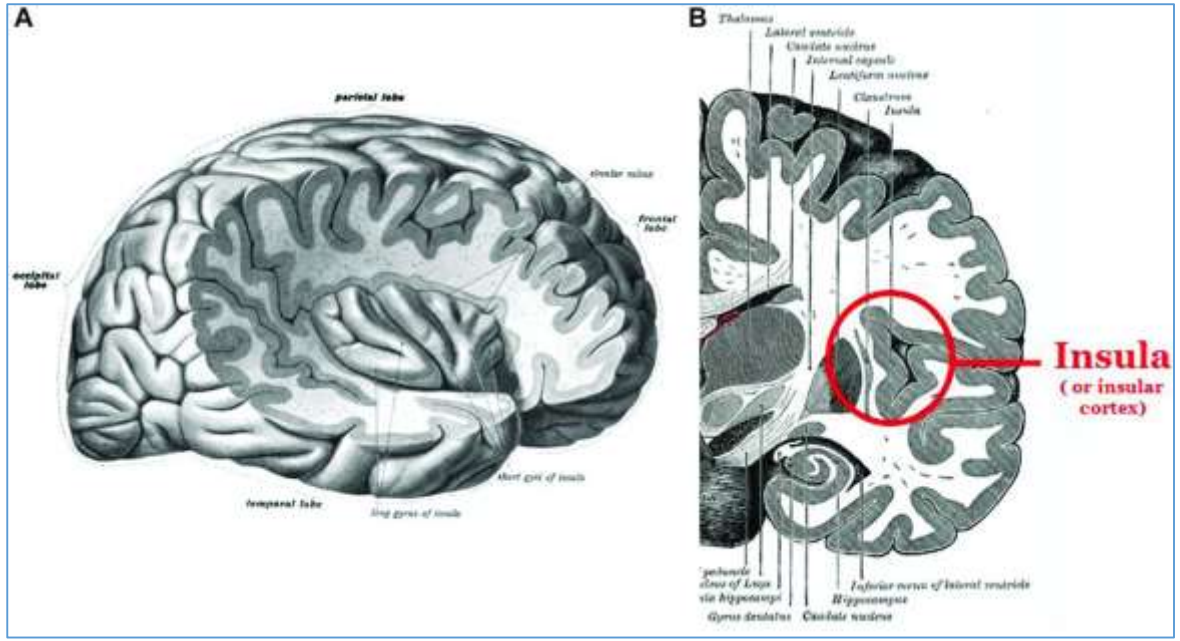
Pictures: MUDr. Alena Sejkorová, Ph.D., Monika Němcová, Antonín Cettl.

Low grade glioma - insula



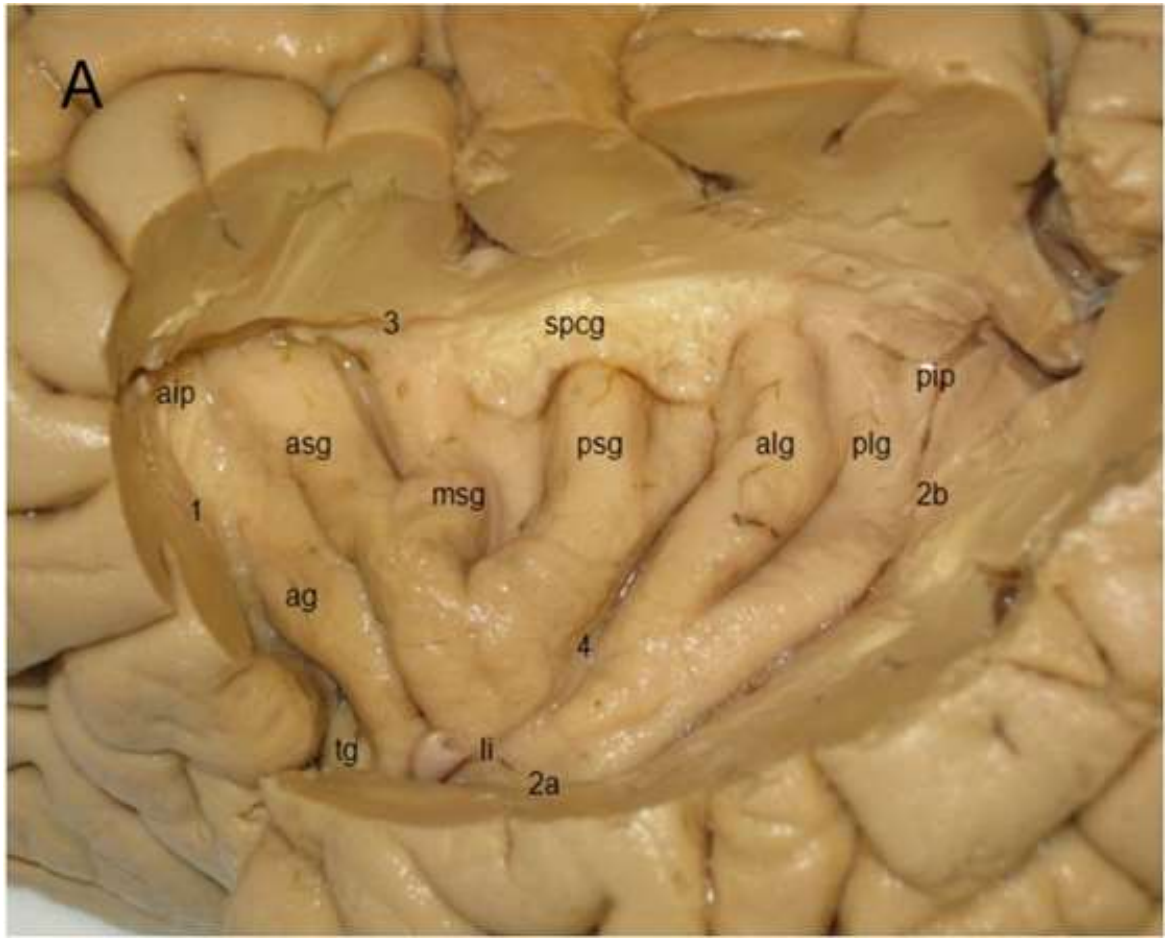
Insula:

chemosensory information (olfaction and taste)
multimodal convergent zone processing:
exteroceptive information (touch, temperature and pain)
interoceptive information (somatovisceral sensitivity)
auditory and vestibular information
and EMOTIONS: connected to the anterior cingulum, amygdala and posterior thalamus:
Function: experience and observation, disgust – with taste and smell, anticipation of fears, feeling of the anger, fault and perception of moral delicts.
Insula directs our behaviour (execution or withdrawal). Lesion: crawing for recreational drugs.

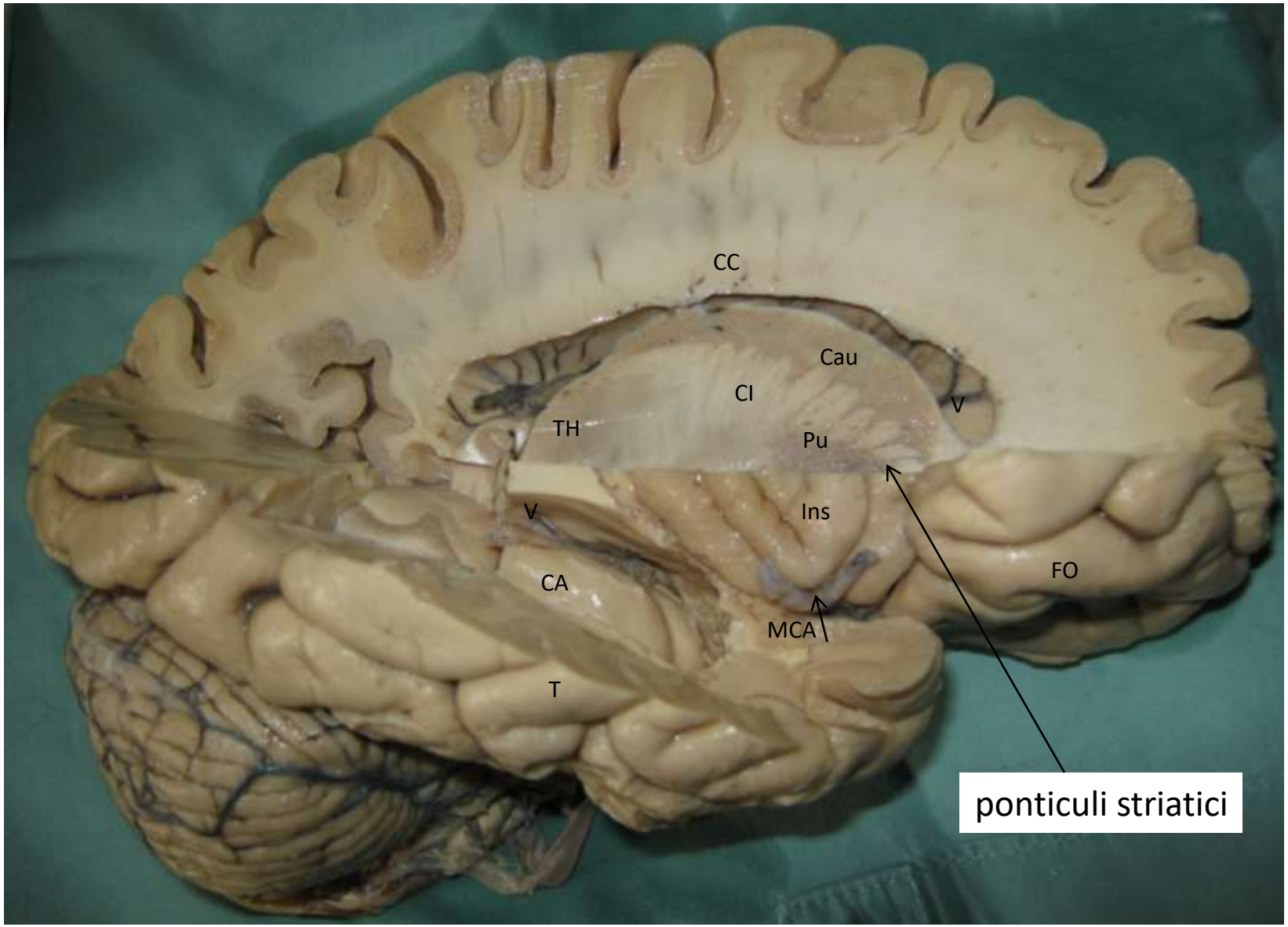


„If surgeon knows the anatomy, he/she operates more safely.“

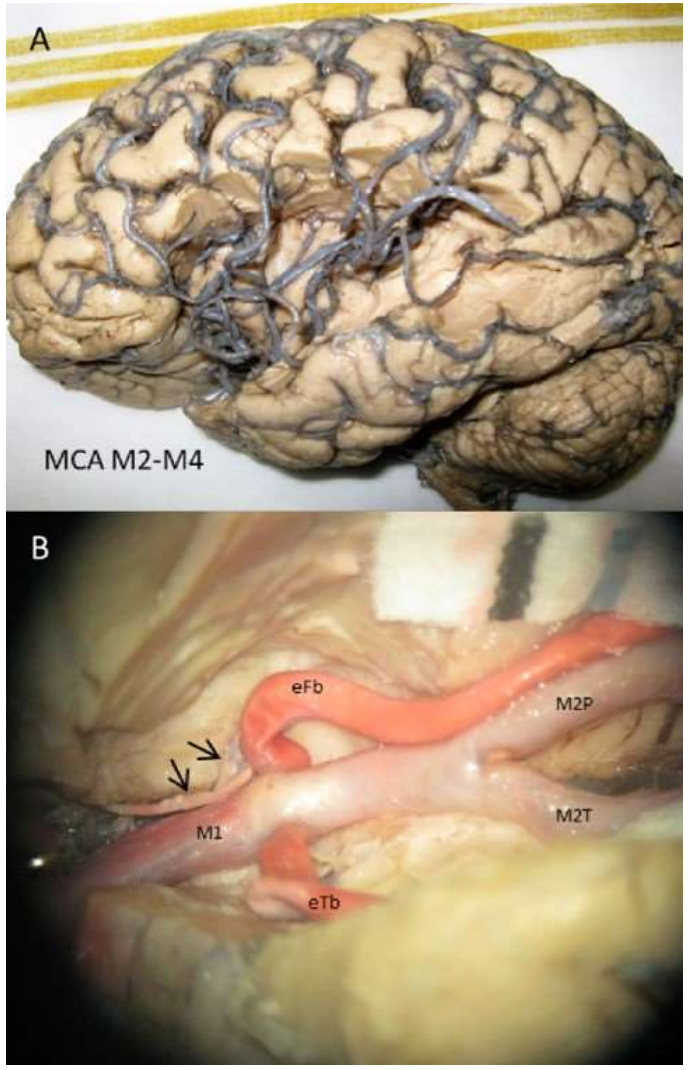
Thanks to: prof. MUDr. Pavel Petrovický, DrSc., as. MUDr. Veronika Němcová, CSc.

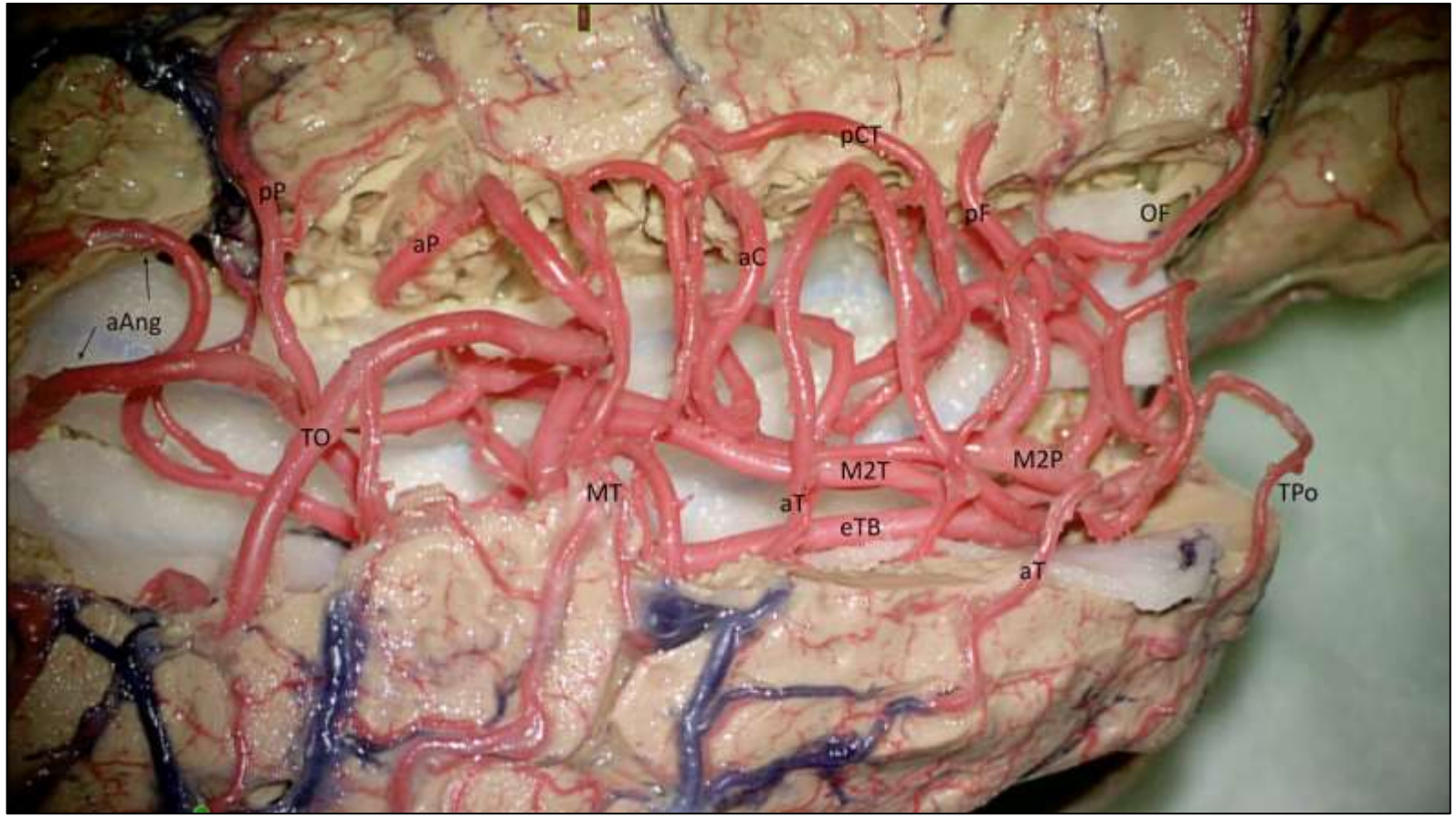


Anatomy – global view



Vascular supply

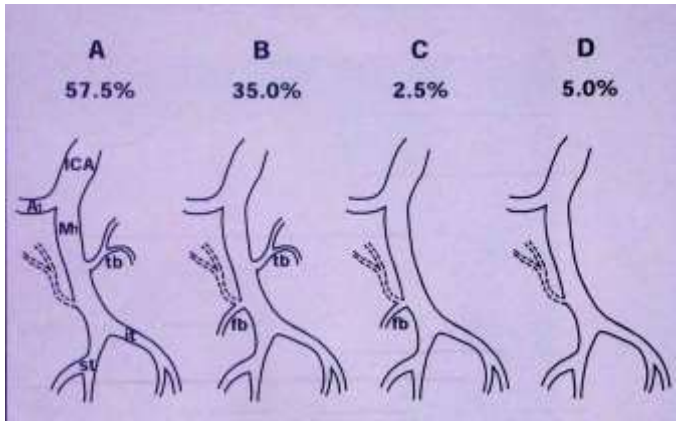


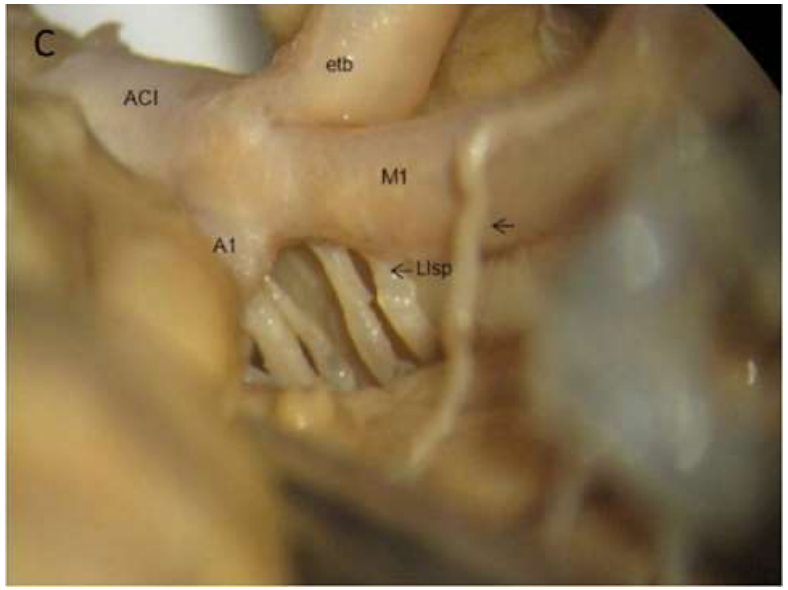


1. Branching variability of MCA + lateral lentikulostriatic perforators M1 a M1/2

Type A 57.5%, B 35.0%, C 2.5%, D 5% (Türe 2000)

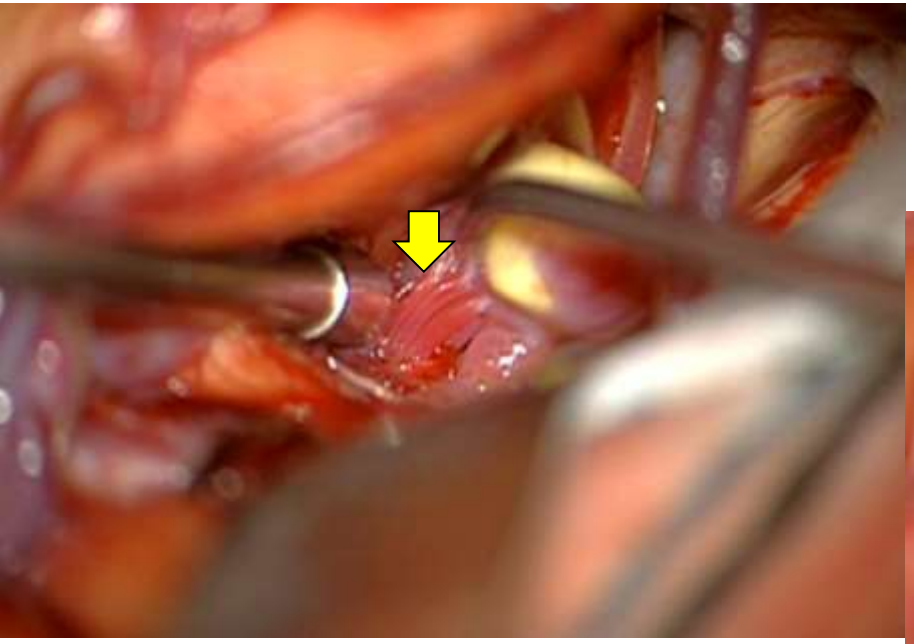
Yaşargil
40% one stem, 30% 2 „large“ paralel arteries, 30% multiple tiny perforators

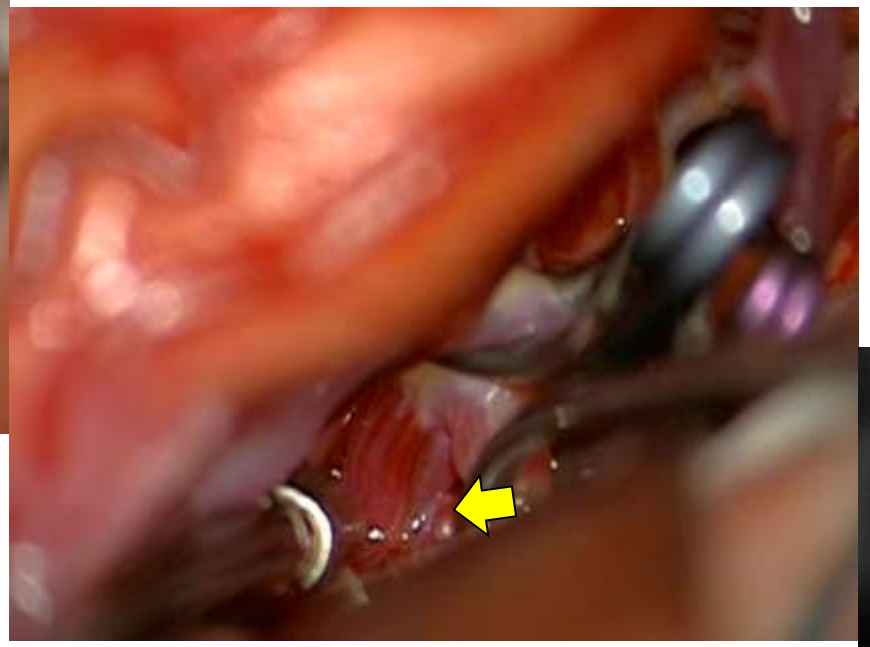




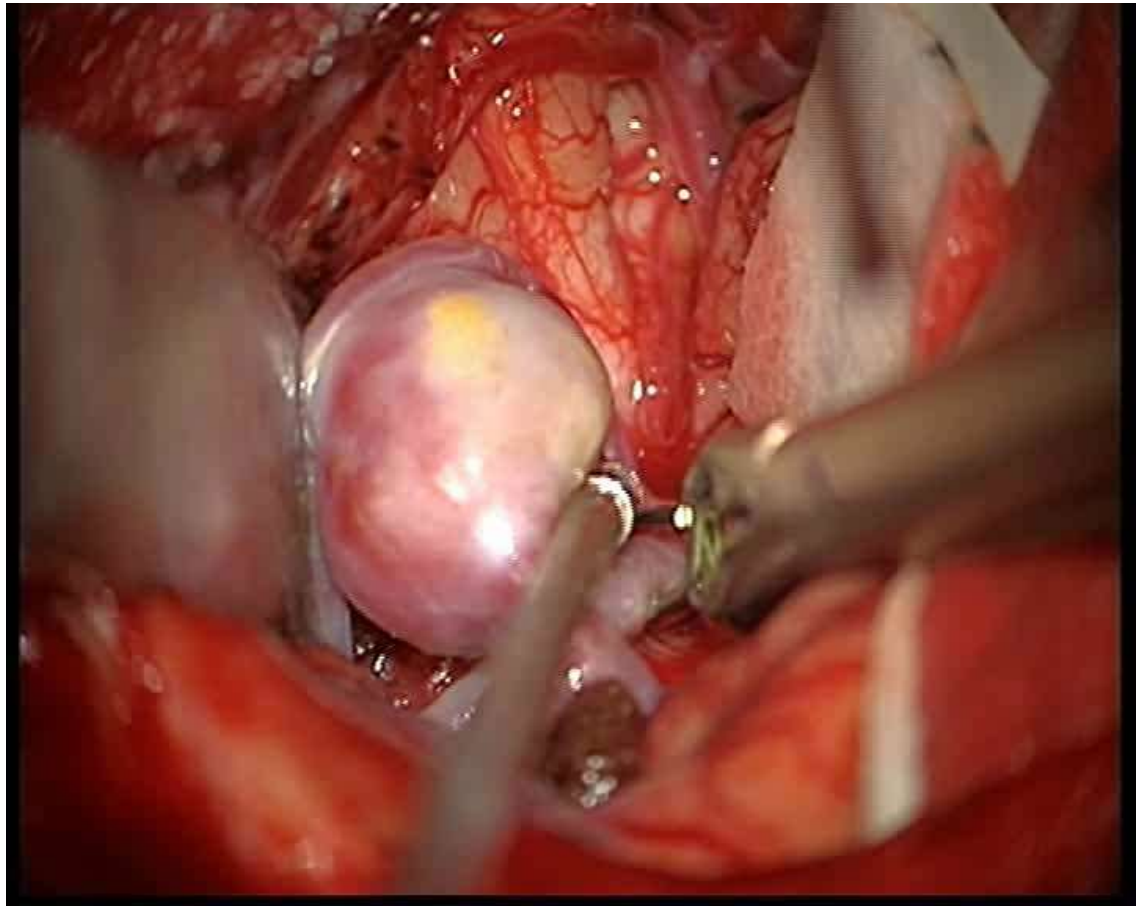
False early bifurcation – perforating arteries (important during aneurysm clipping)

Aneurysm surgery



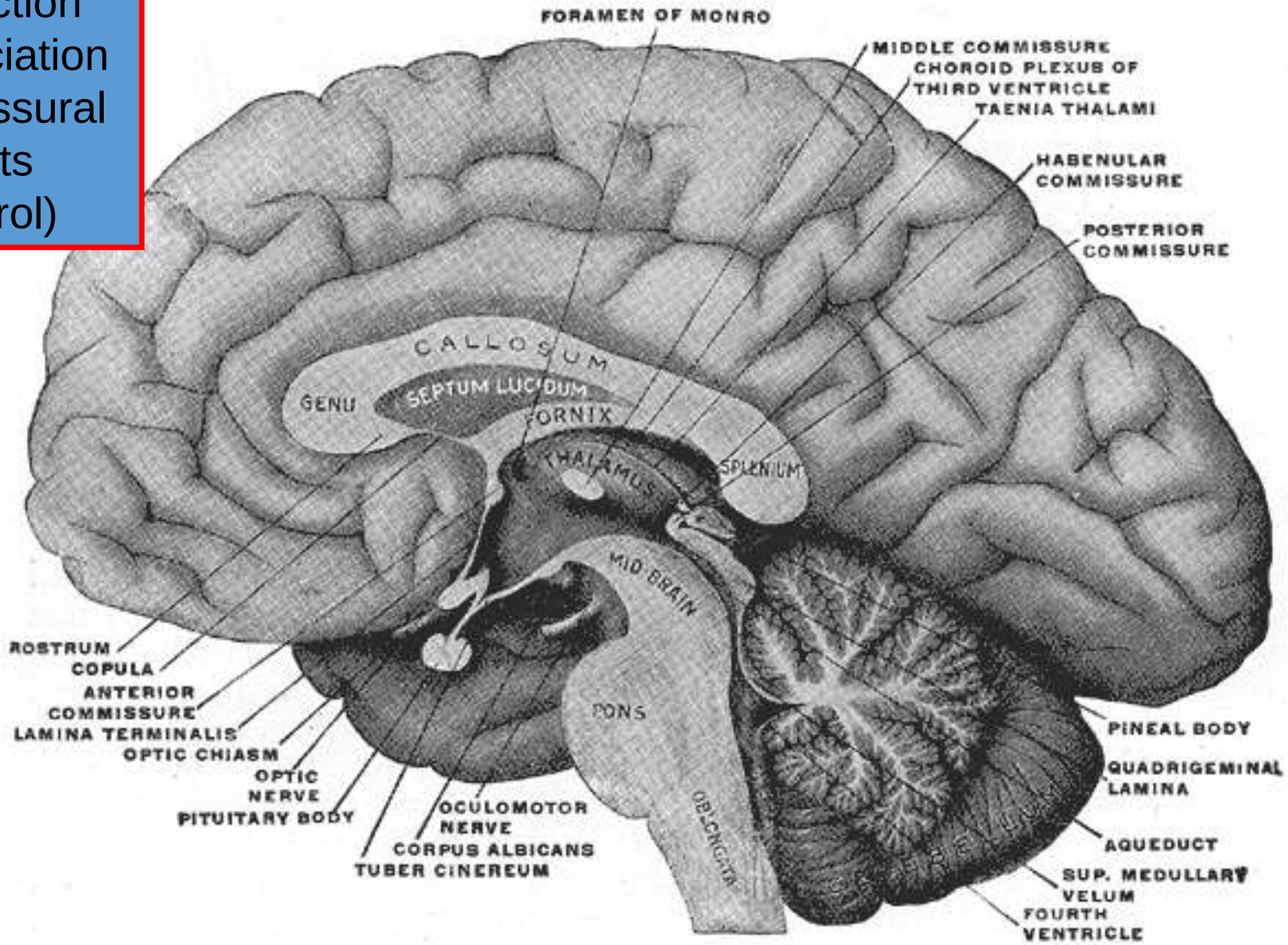


Surgery - clip

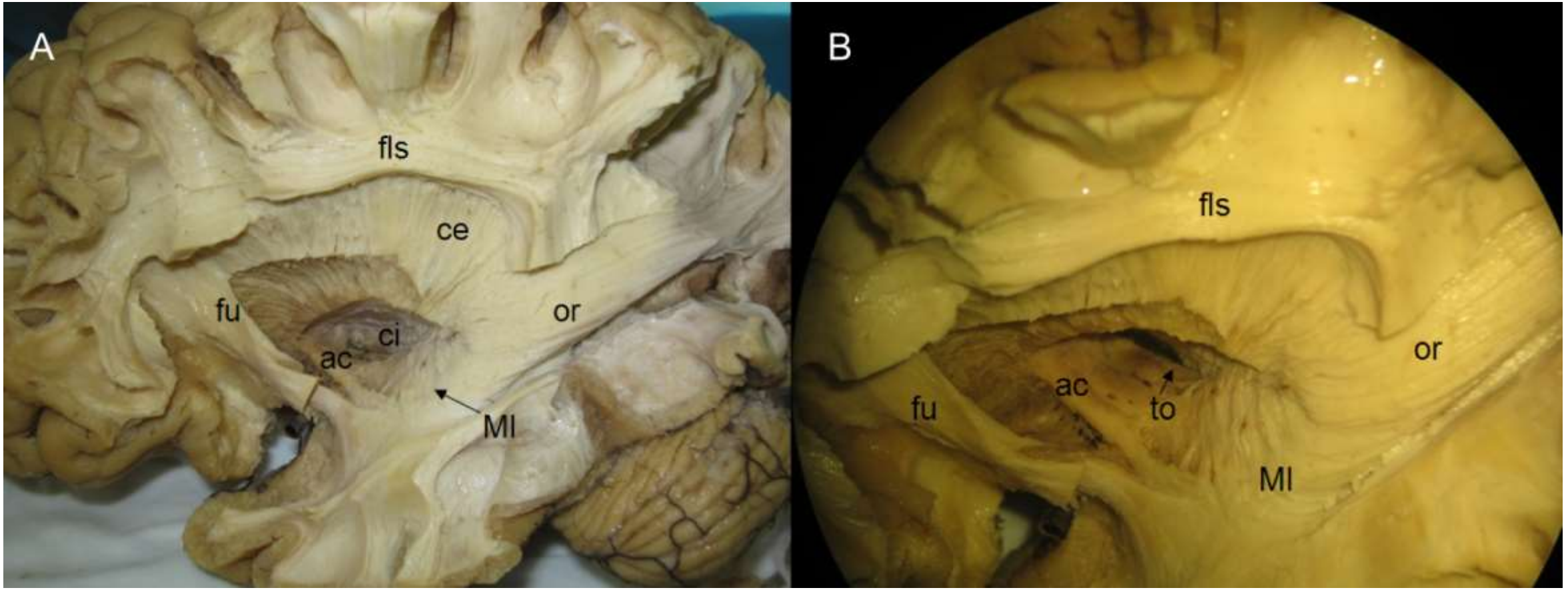


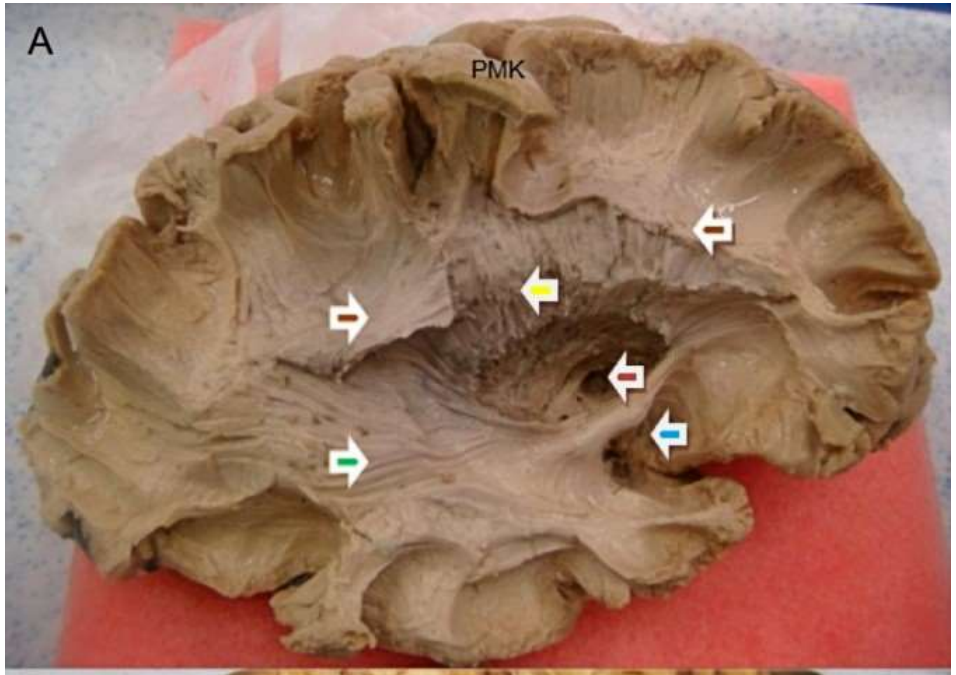
Tracts

Projection
Association
Comissural
Circuits
(Control)



Dissection of cerebral tracts by the Klingler technique

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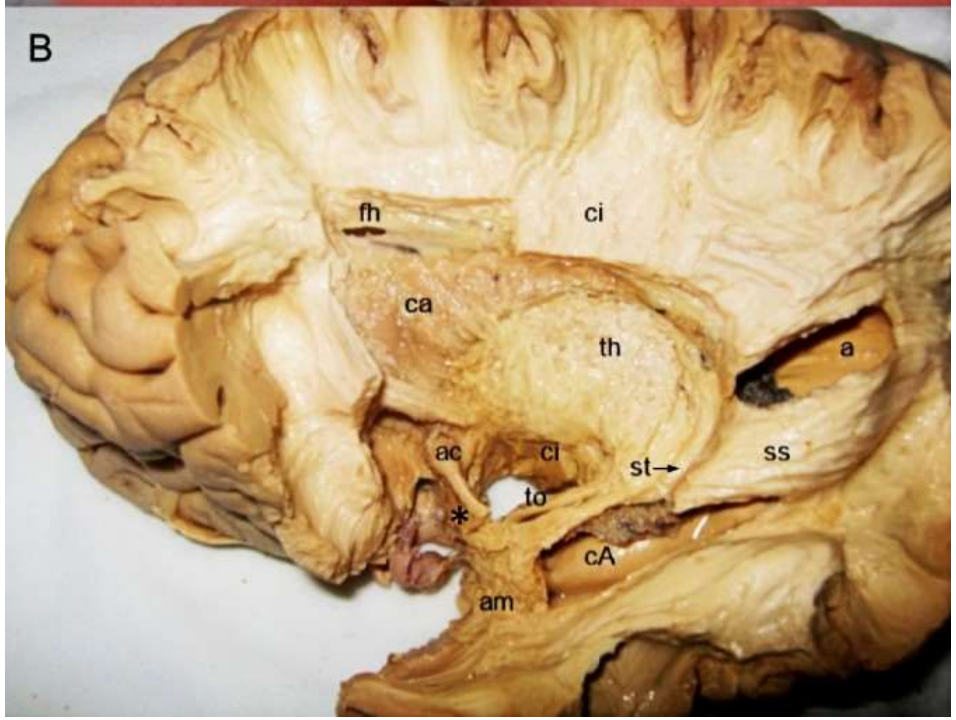
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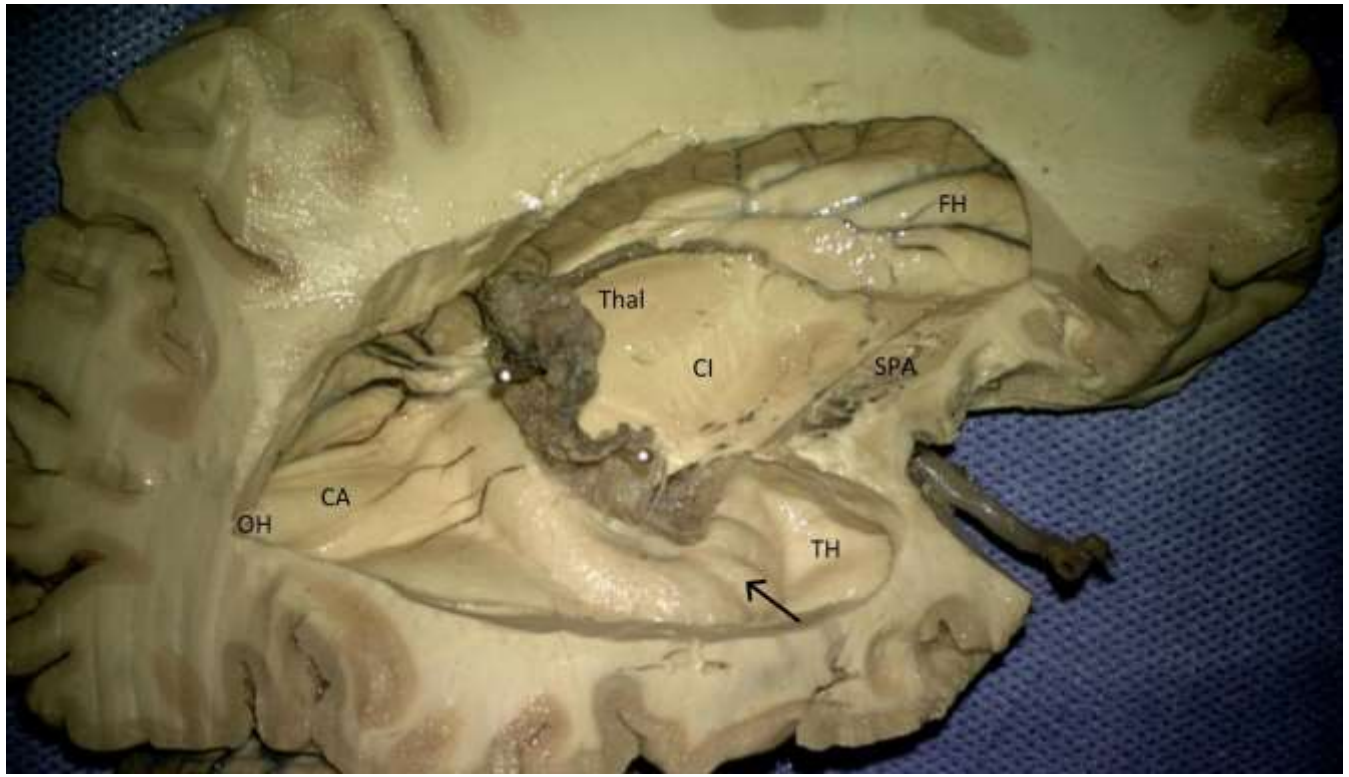
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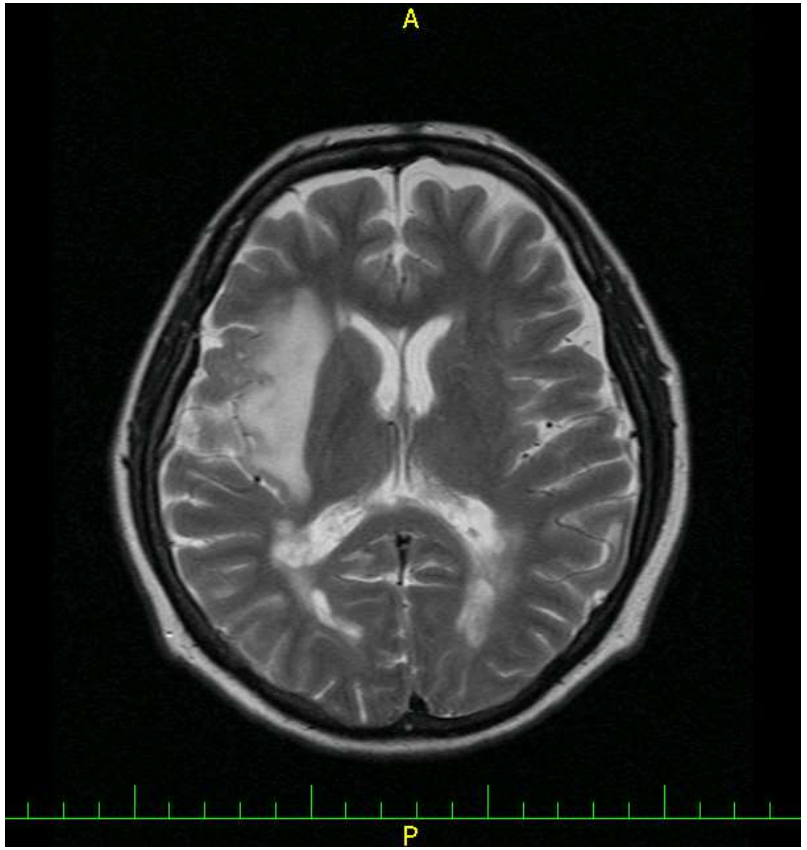
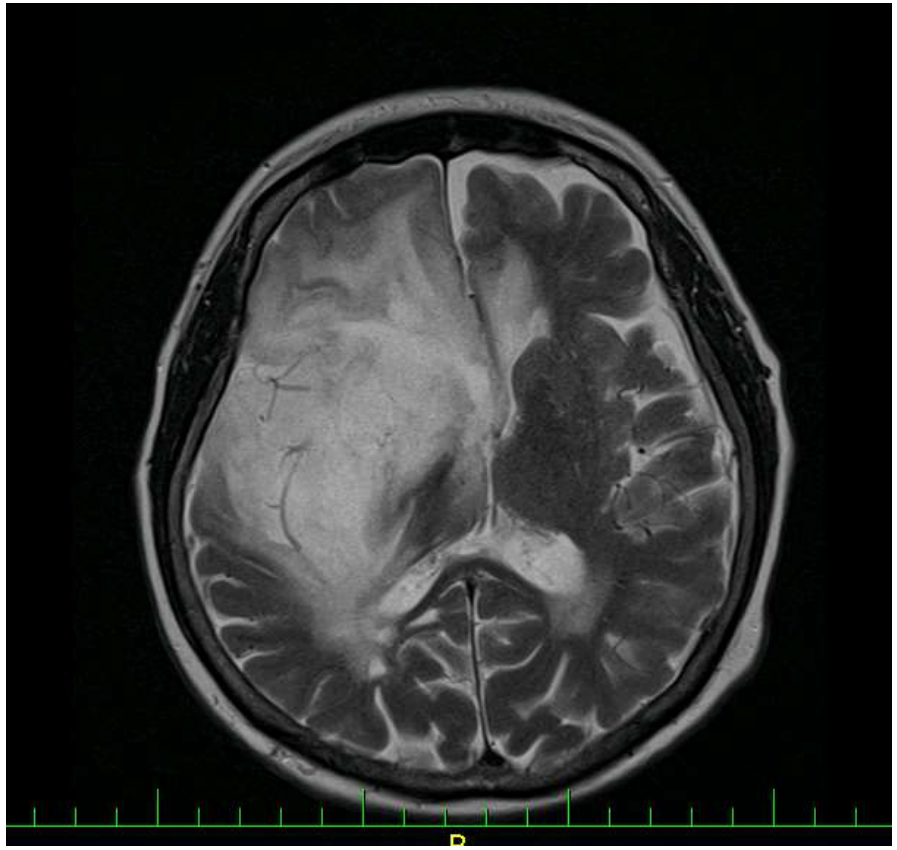
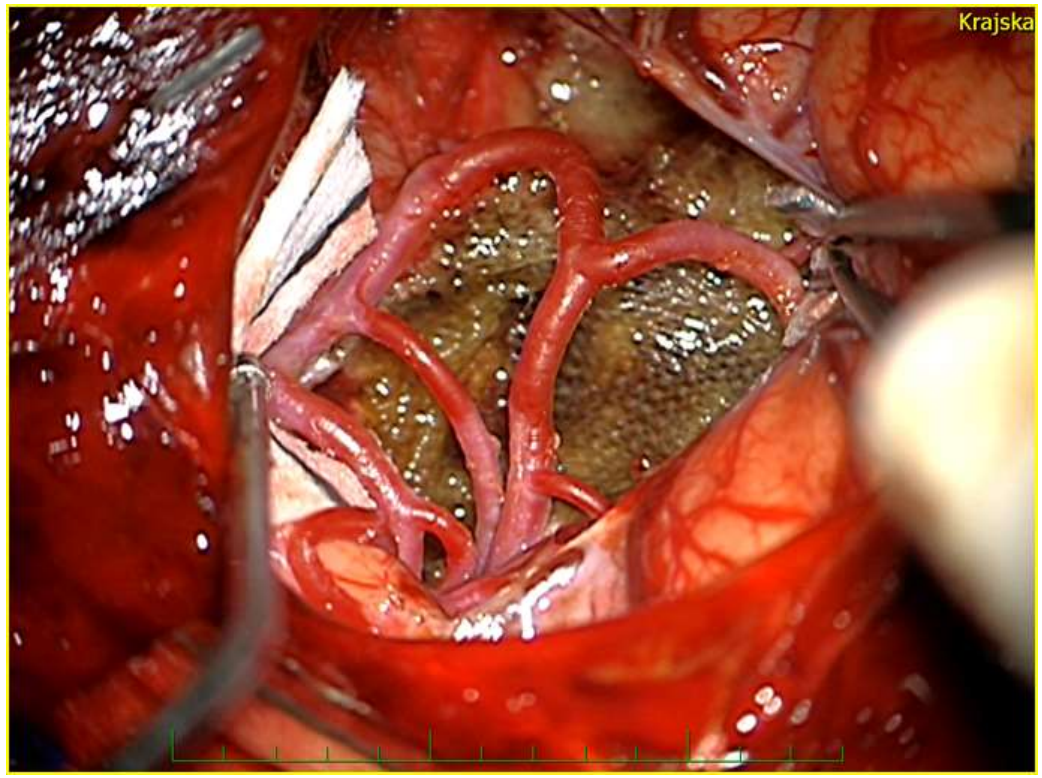
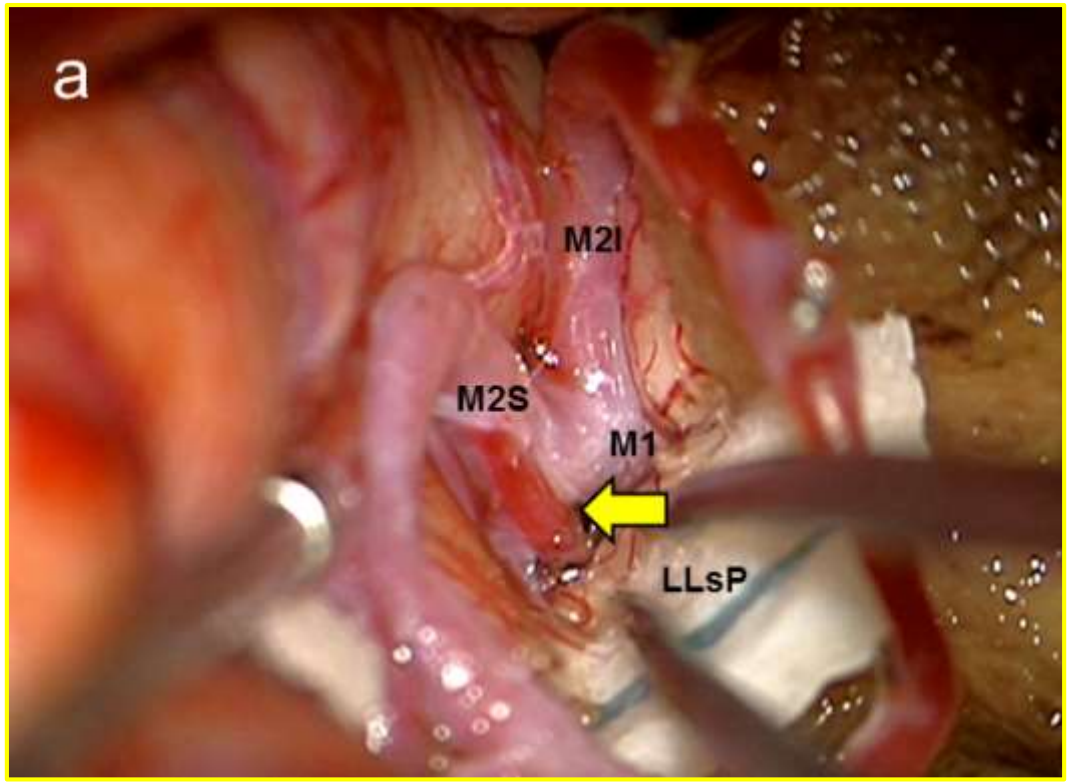


2012



Surgical technique: Microsurgery



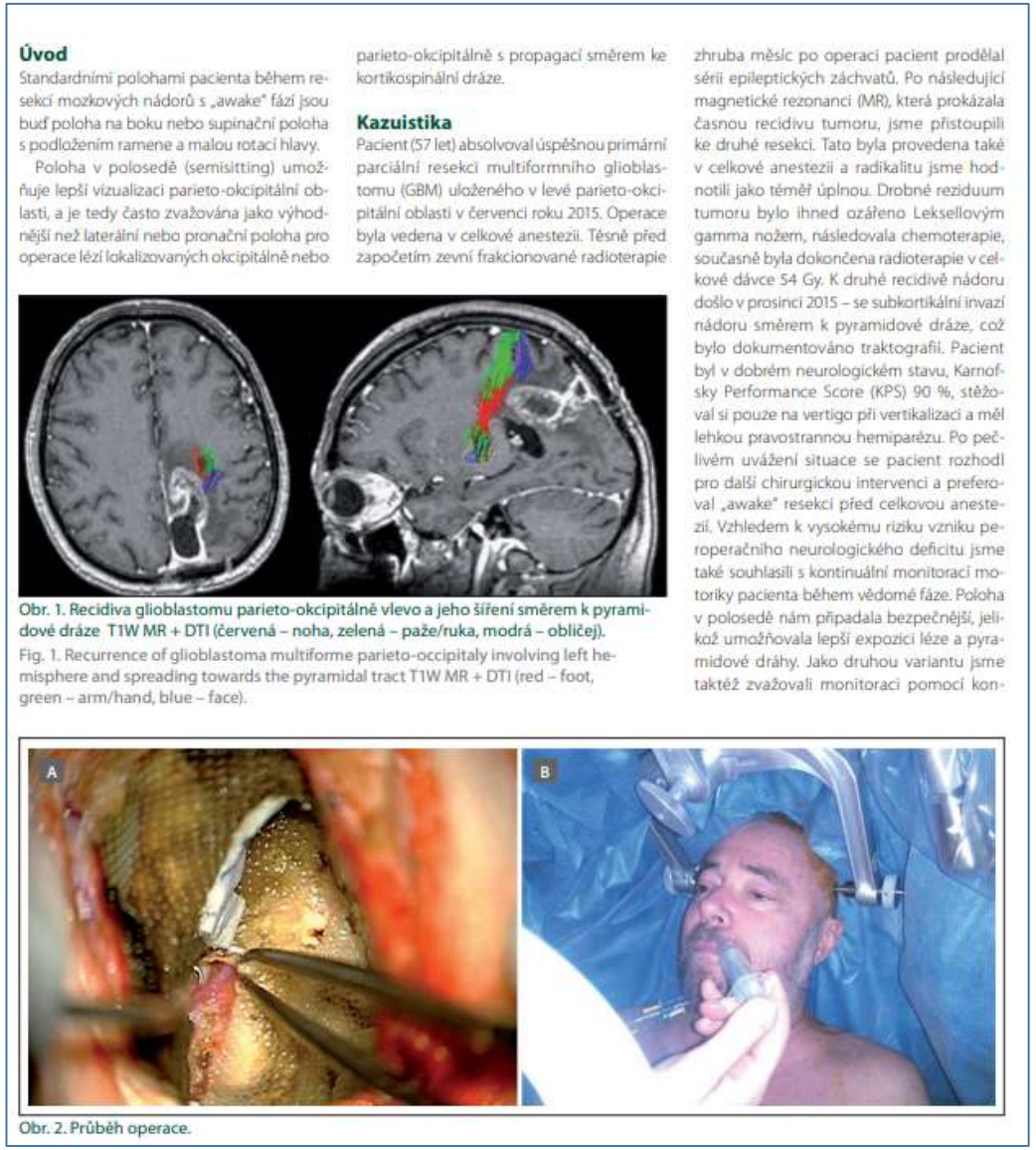


Awake resection – some limitation

(time, tolerance by the patient and surgeon, anesthesiologist, speech specialist - logopaedic)

„Awake" resekce gliomu v poloze pacienta v polosedě – kazuistika

"Awake" Resection of Glioma in Semisitting – a Case Report



Úvod

Standardními polohami pacienta během resekcí mozkových nádorů s „awake" fází jsou buď poloha na boku nebo supinační poloha s podložením ramene a malou rotací hlavy.

Poloha v polosedě (semisitting) umožňuje lepší vizualizaci parieto-okcipitální oblasti, a je tedy často zvažována jako výhodnější než laterální nebo pronační poloha pro operace lézí lokalizovaných okcipitálně nebo parieto-okcipitálně s propagací směrem ke kortikospinální dráze.

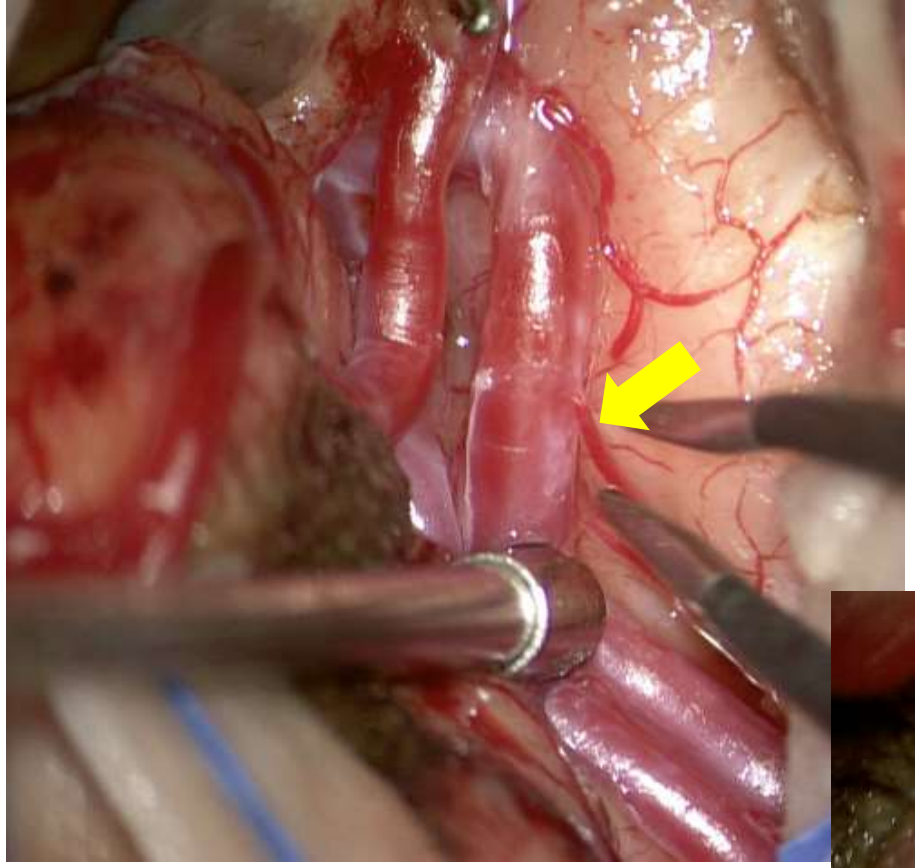
Kazuistika

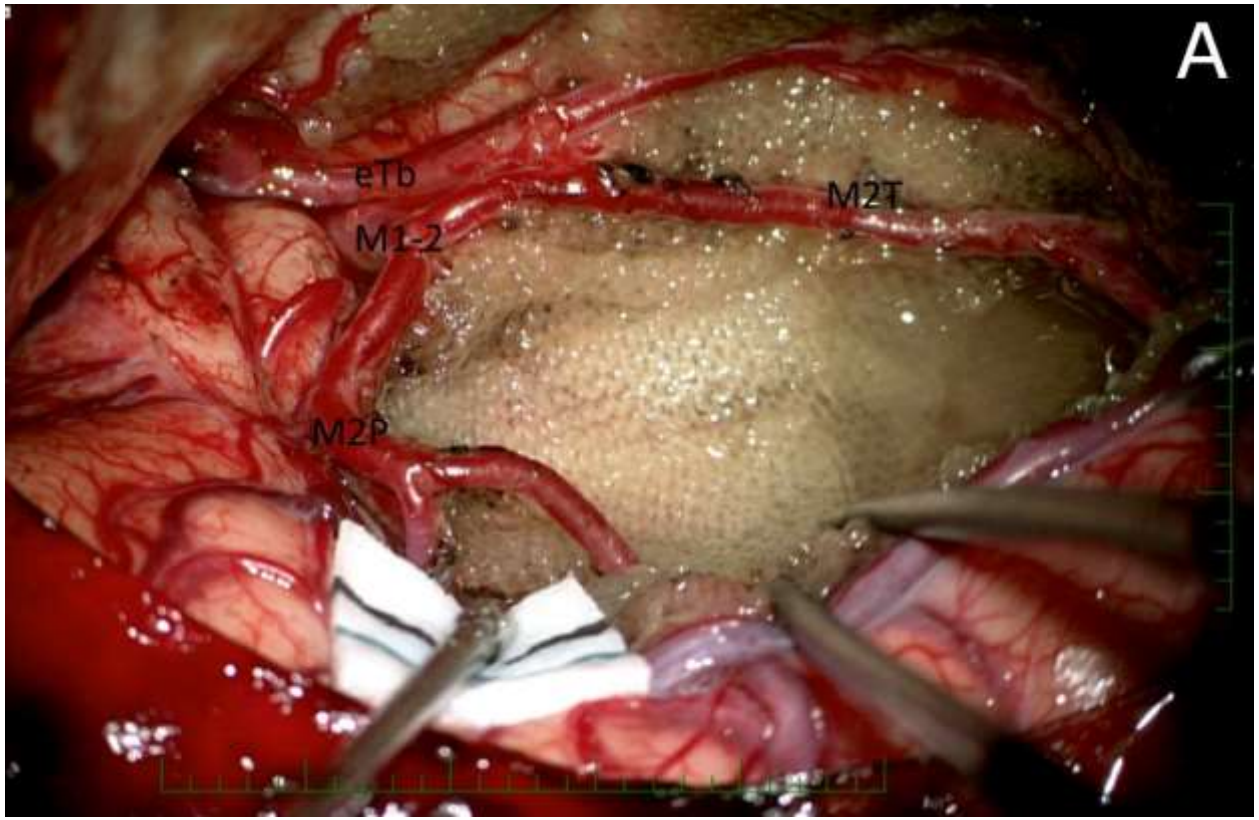
Pacient (57 let) absolvoval úspěšnou primární parciální resekci multiformního glioblastomu (GBM) uloženého v levé parieto-okcipitální oblasti v červenci roku 2015. Operace byla vedena v celkové anestezii. Těsně před započetím zevní frakcionované radioterapie zhruba měsíc po operaci pacient prodělal sérii epileptických záchvatů. Po následující magnetické rezonanci (MR), která prokázala časnou recidivu tumoru, jsme přistoupili ke druhé resekci. Tato byla provedena také v celkové anestezii a radikalitu jsme hodnotili jako téměř úplnou. Drobné reziduum tumoru bylo ihned ozářeno Leksellovým gamma nožem, následovala chemoterapie, současně byla dokončena radioterapie v celkové dávce 54 Gy. K druhé recidivě nádoru došlo v prosinci 2015 – se subkortikální invazí nádoru směrem k pyramidové dráze, což bylo dokumentováno traktografií. Pacient byl v dobrém neurologickém stavu, Karnofsky Performance Score (KPS) 90 %, stěžoval si pouze na vertigo při vertikalizaci a měl lehkou pravostrannou hemiparézu. Po pečlivém uvážení situace se pacient rozhodl pro další chirurgickou intervenci a preferoval „awake" resekci před celkovou anestezií. Vzhledem k vysokému riziku vzniku peroperačního neurologického deficitu jsme také souhlasili s kontinuální monitorací motoriky pacienta během vědomé fáze. Poloha v polosedě nám připadala bezpečnější, jelikož umožňovala lepší expozici léze a pyramidové dráhy. Jako druhou variantu jsme taktéž zvažovali monitoraci pomocí kon-

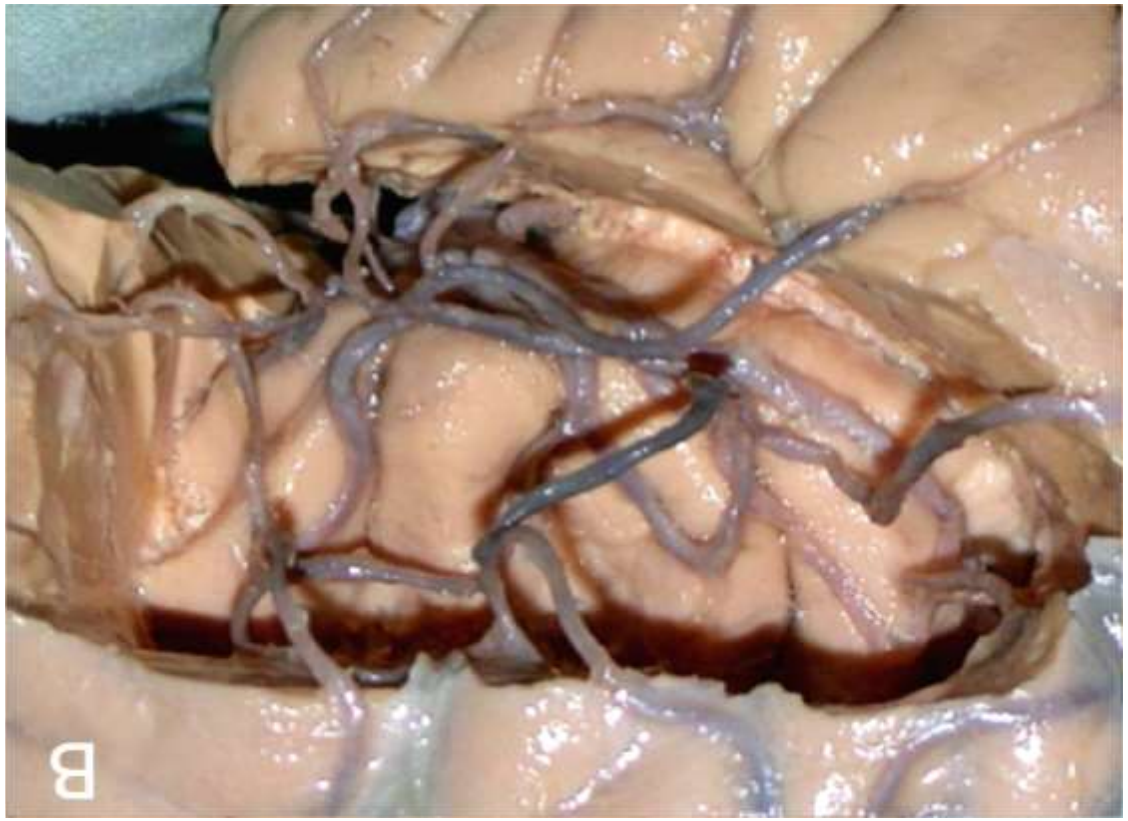
Obr. 1. Recidiva glioblastomu parieto-okcipitálně vlevo a jeho šíření směrem k pyramidové dráze T1W MR + DTI (červená – noha, zelená – paže/ruka, modrá – obličej).

Fig. 1. Recurrence of glioblastoma multiforme parieto-occipitaly involving left hemisphere and spreading towards the pyramidal tract T1W MR + DTI (red – foot, green – arm/hand, blue – face).

Obr. 2. Průběh operace.







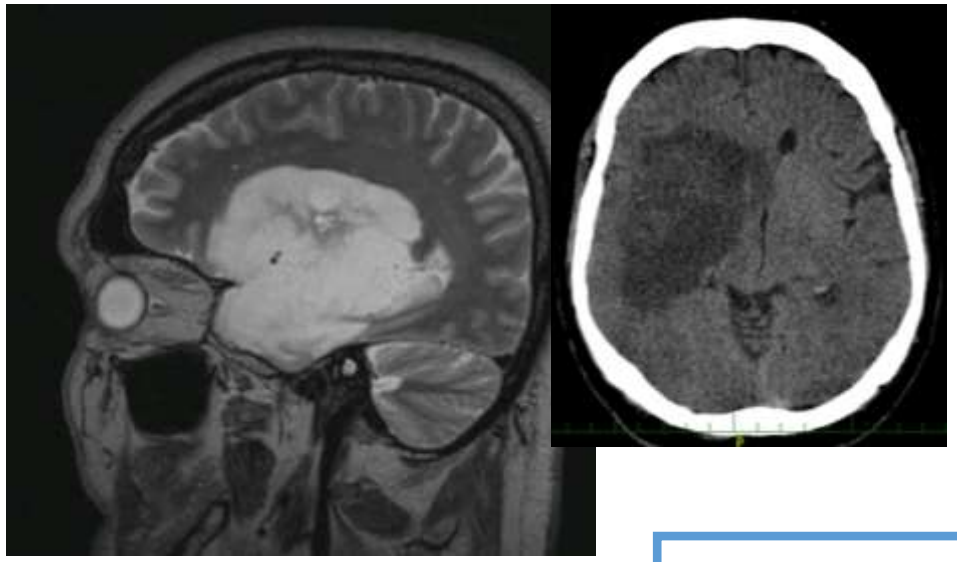
Results from 2008:

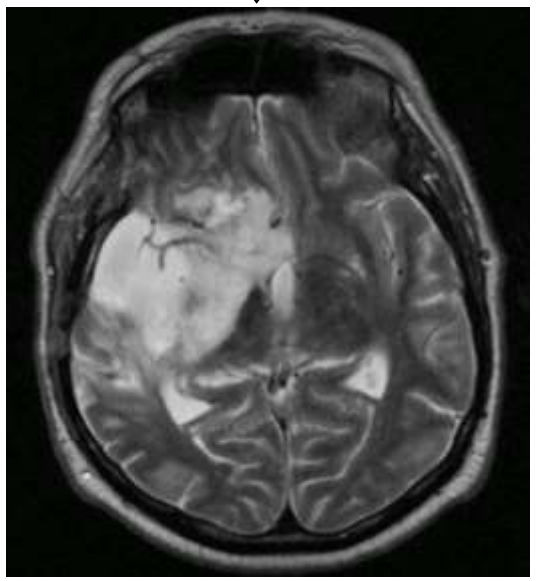
31 insular gliomas

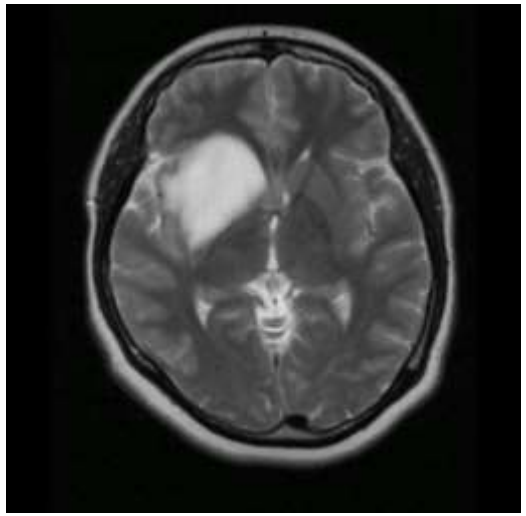
Very severe morbidity 2 patients (6,4%) bleeding into the residual tumour

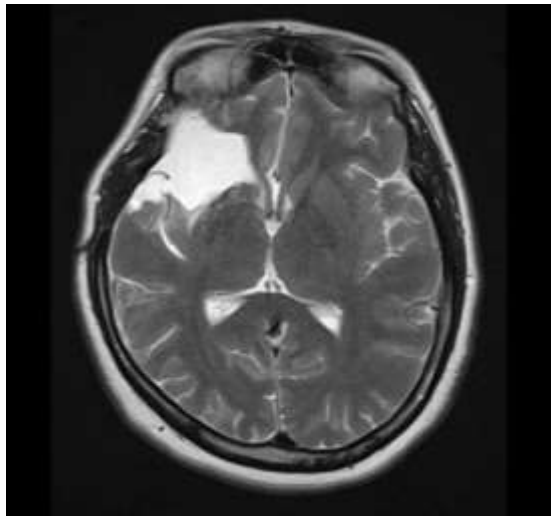
volumetric radicality **82% for all insular tumours (glioblastoma, anaplastic astrocytoma, low grade glioma)**

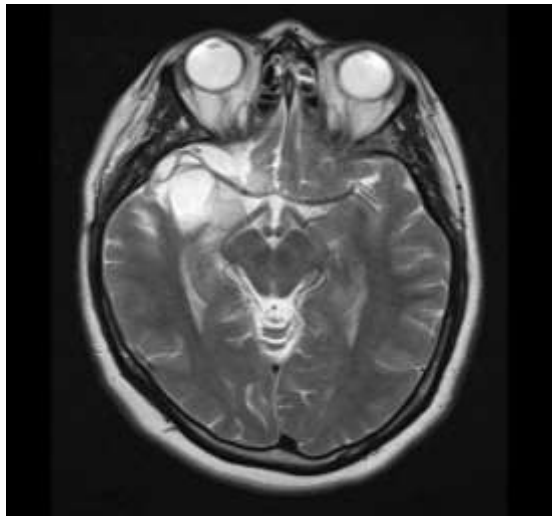
In LGG and AA we achieved av. 80% (56 -100%)
reduction of the tumour volume - MRI volumetry.



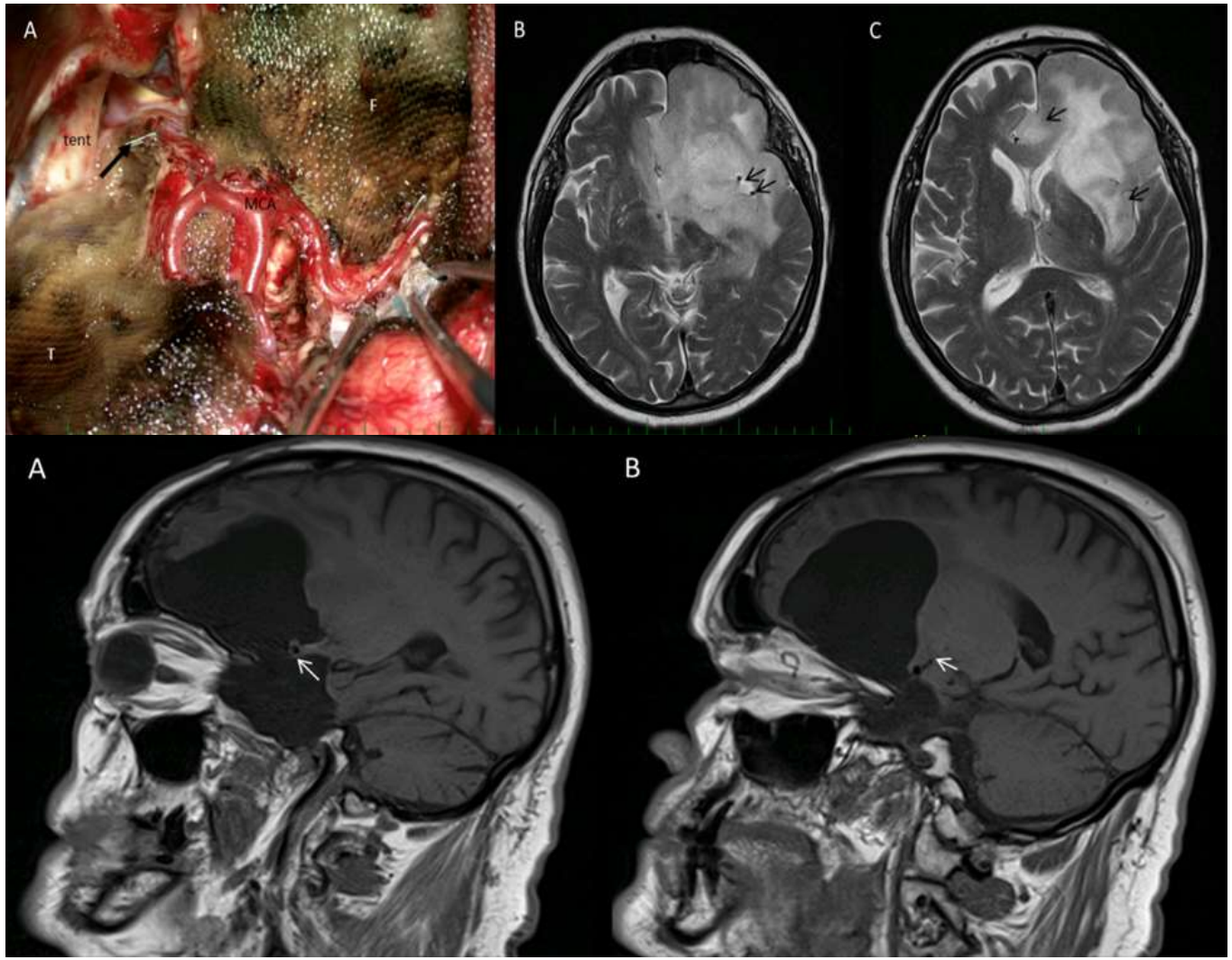


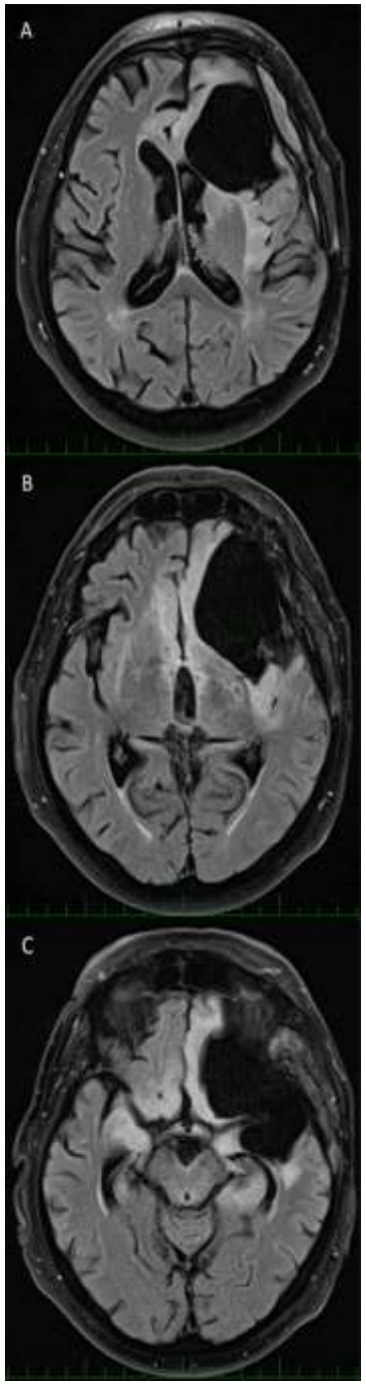






Complex tumours (Yaşargil 5B)



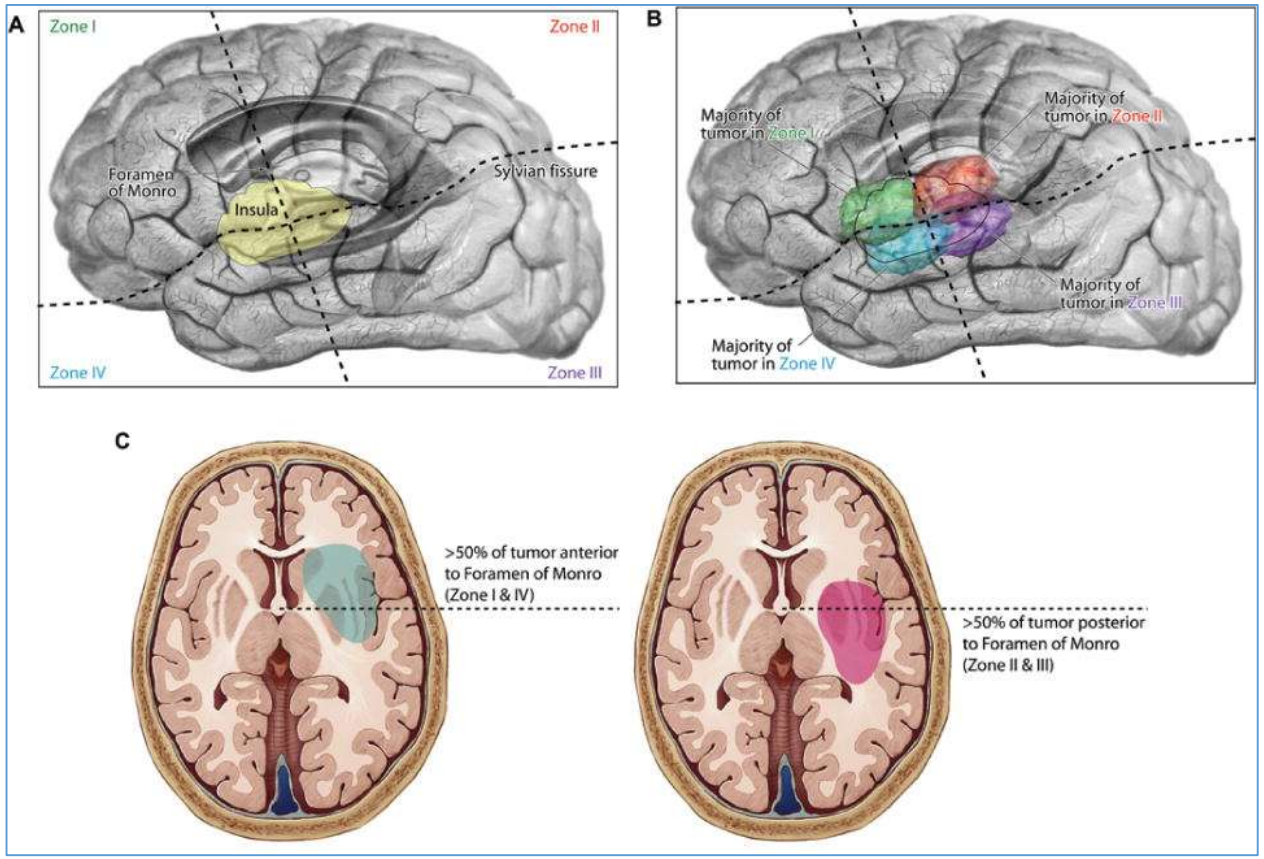


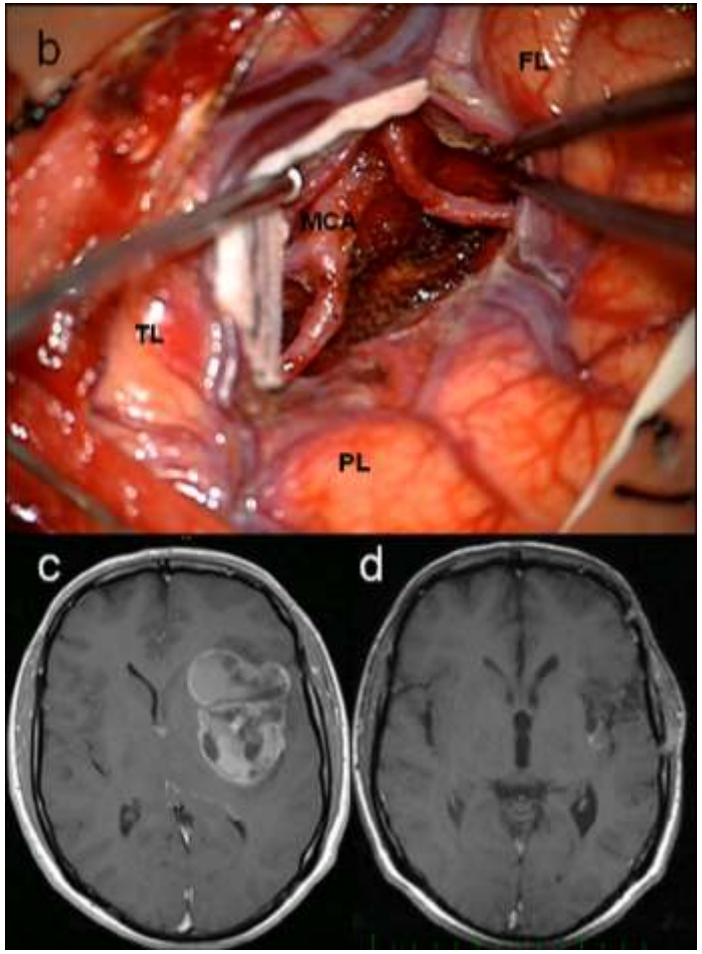
Vascular lesions: Supero-posterior quadrant (Berger - Sanai): better transcortical than transsylvian approch (lateral cerebral fissure)
Benet A, Hervey-Jumper SL, Sánchez JJ, Lawton MT, Berger MS. J Neurosurg. 2016 Feb;124(2):469-81.

In our patient group – any vascular lesion („large“ vessel nor perforating vessel in insular tumours)

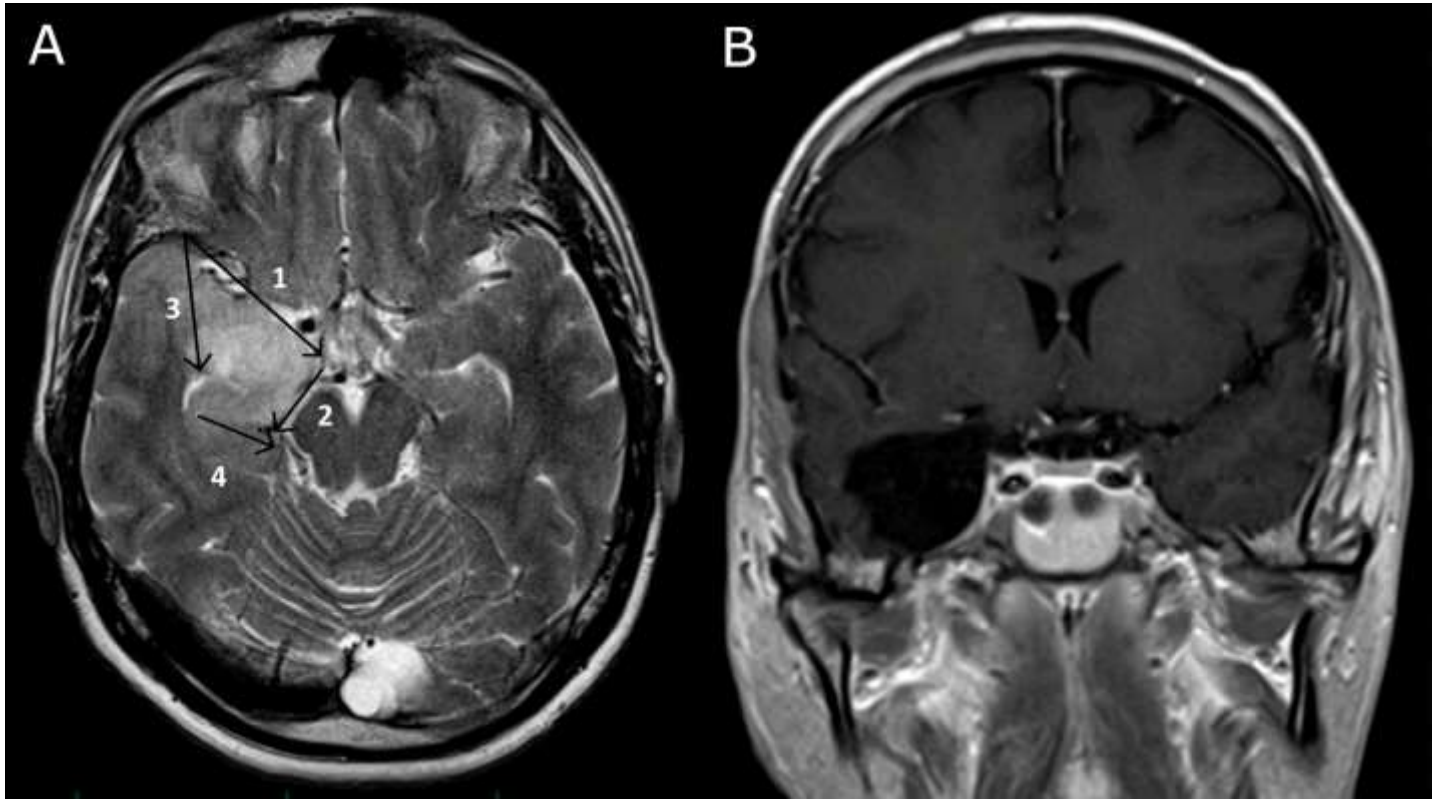
LGG x GBM – 1 x late ischemic stroke 10 days after the surgery, tumour more adhesive to the vessels

all complications in insular tumours due to bleeding into the tumour remnant (residual)



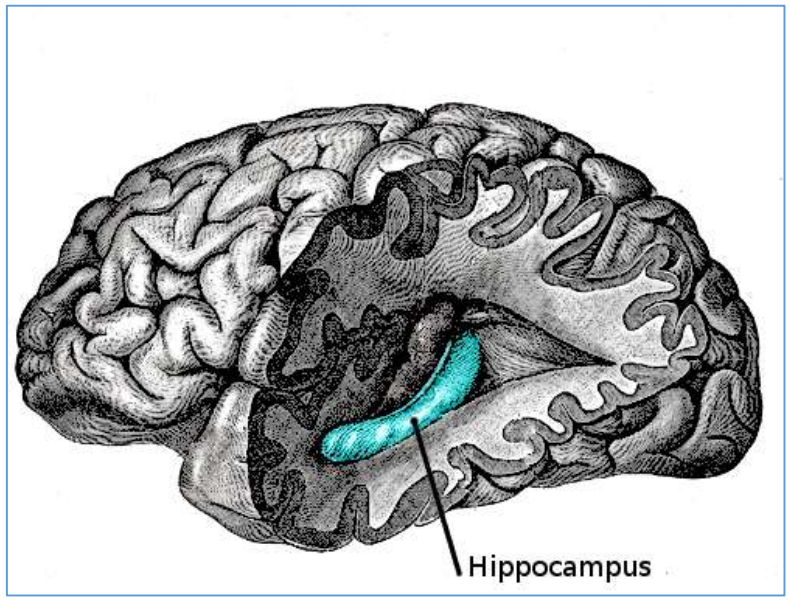


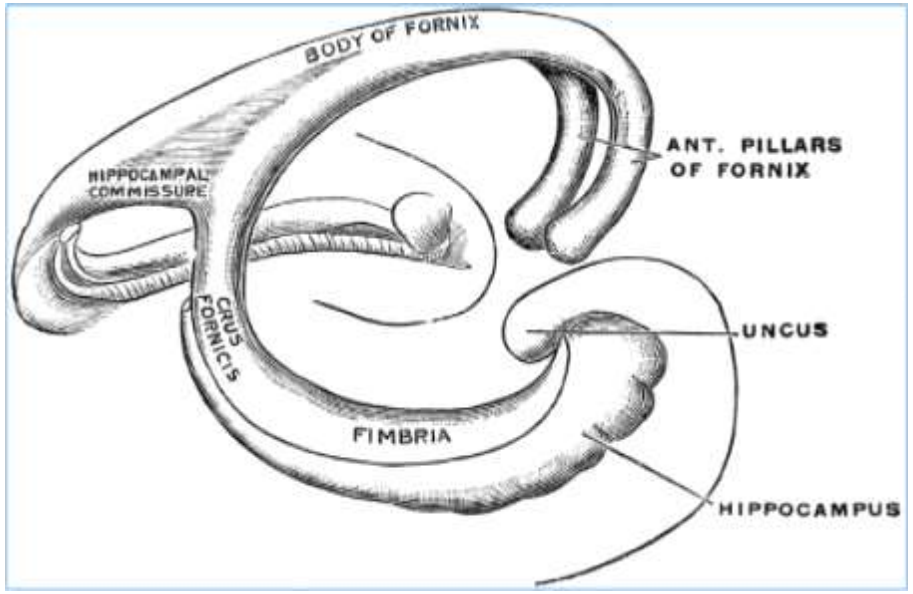
Low grade glioma - hippocampus

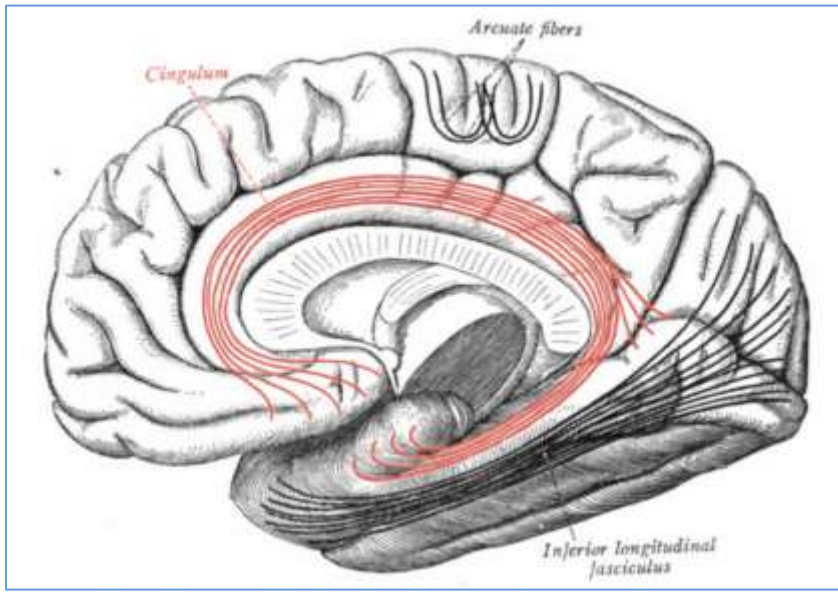


Amygdaloid body + hippocampus + cingulum: Limbic system

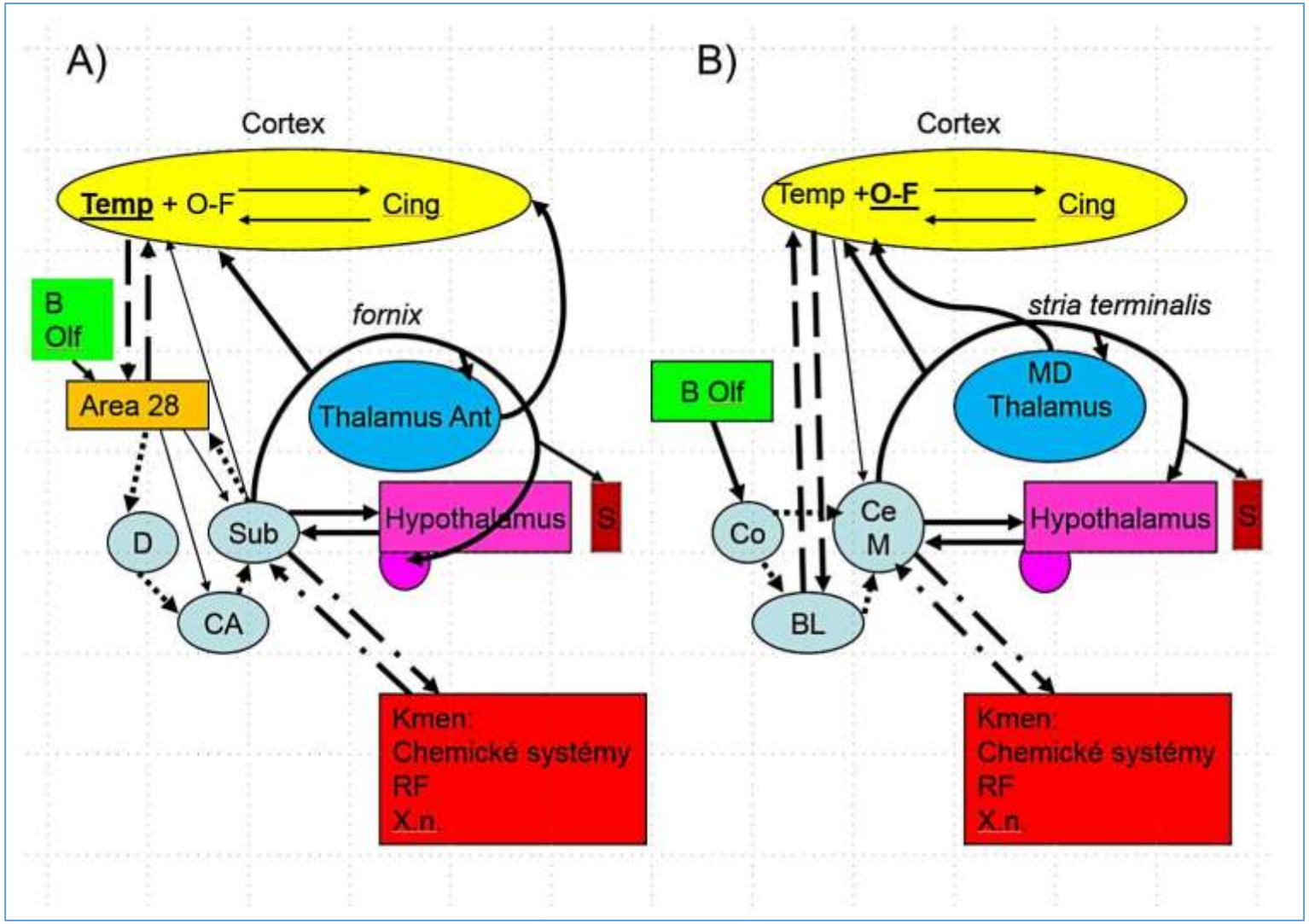
emotion reactions (anger, fear x happiness)
olfactory area
memory and motivation, consolidation of the memory footprint, space memory
sexual behaviour + social behaviour + care for the offspring (children)
superior to the autonomic functions – affects the feeling of the pain
selection of the motion plan



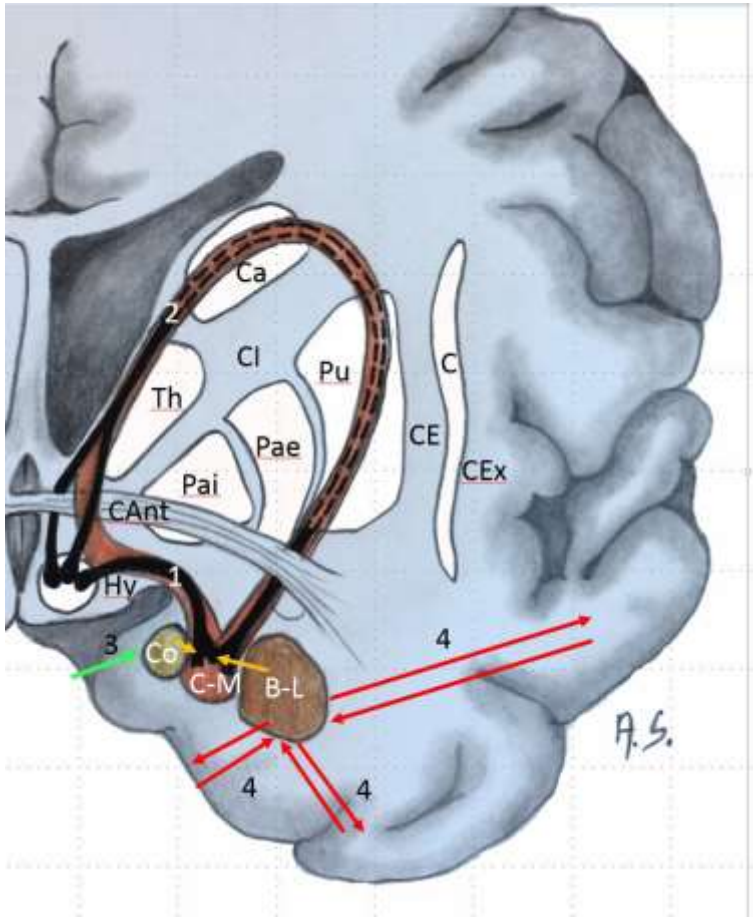




Hippocampus x amygdala

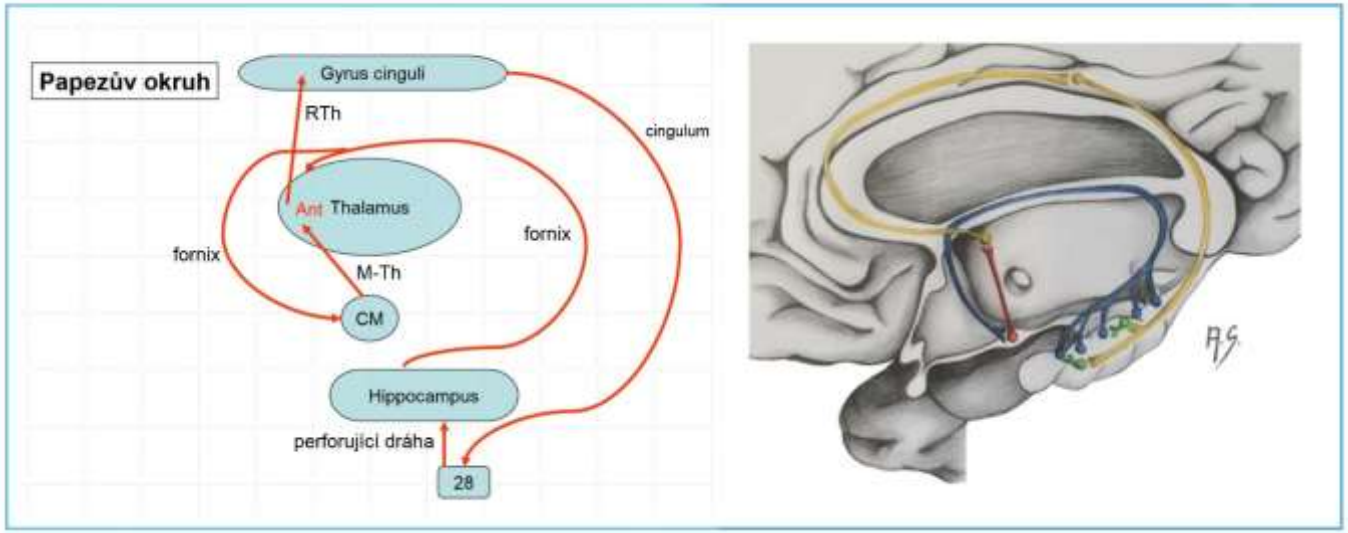


Amygdala



Amygdala …. Brain stem + hypothalamus (stria terminalis – dorsal amygdalofugal pathway)

Amygdala …. Frontal cortex (fasciculus uncinatus – ventral amygdalofugal pathway)


Papezův okruh
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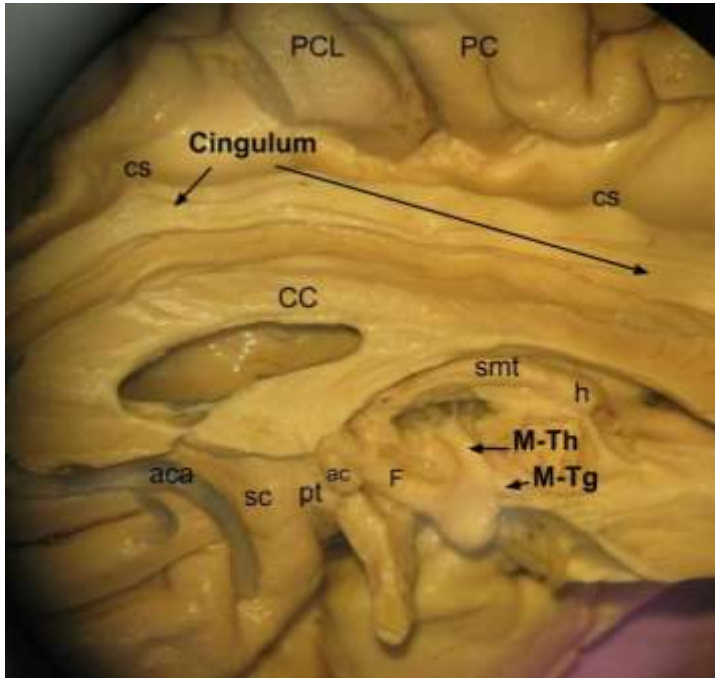
fornix
M-Th
CM
Hippocampus
perforující dráha
28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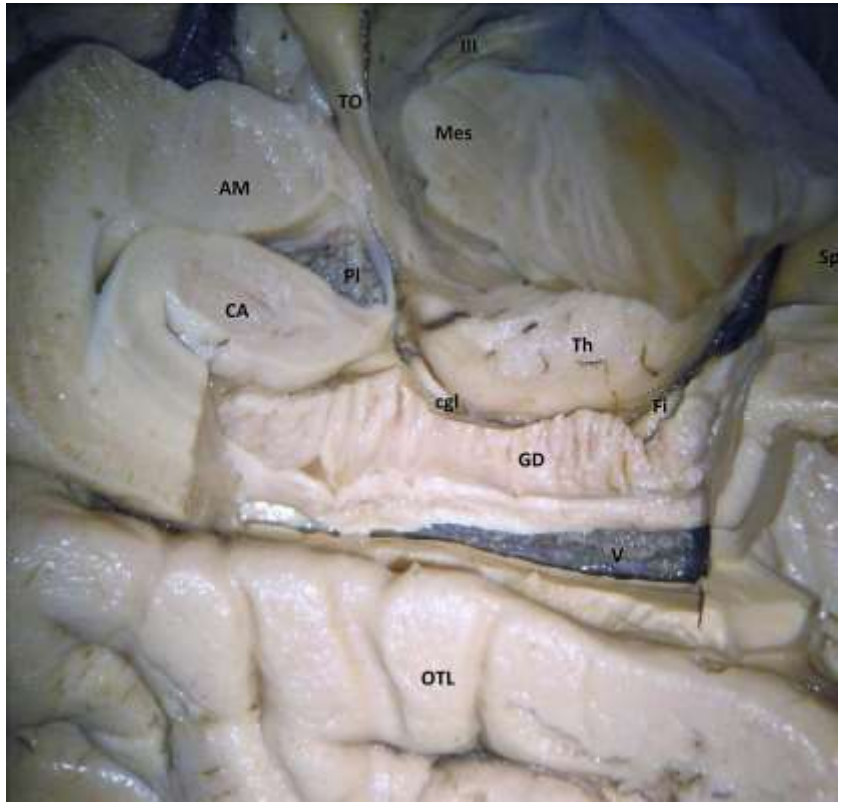
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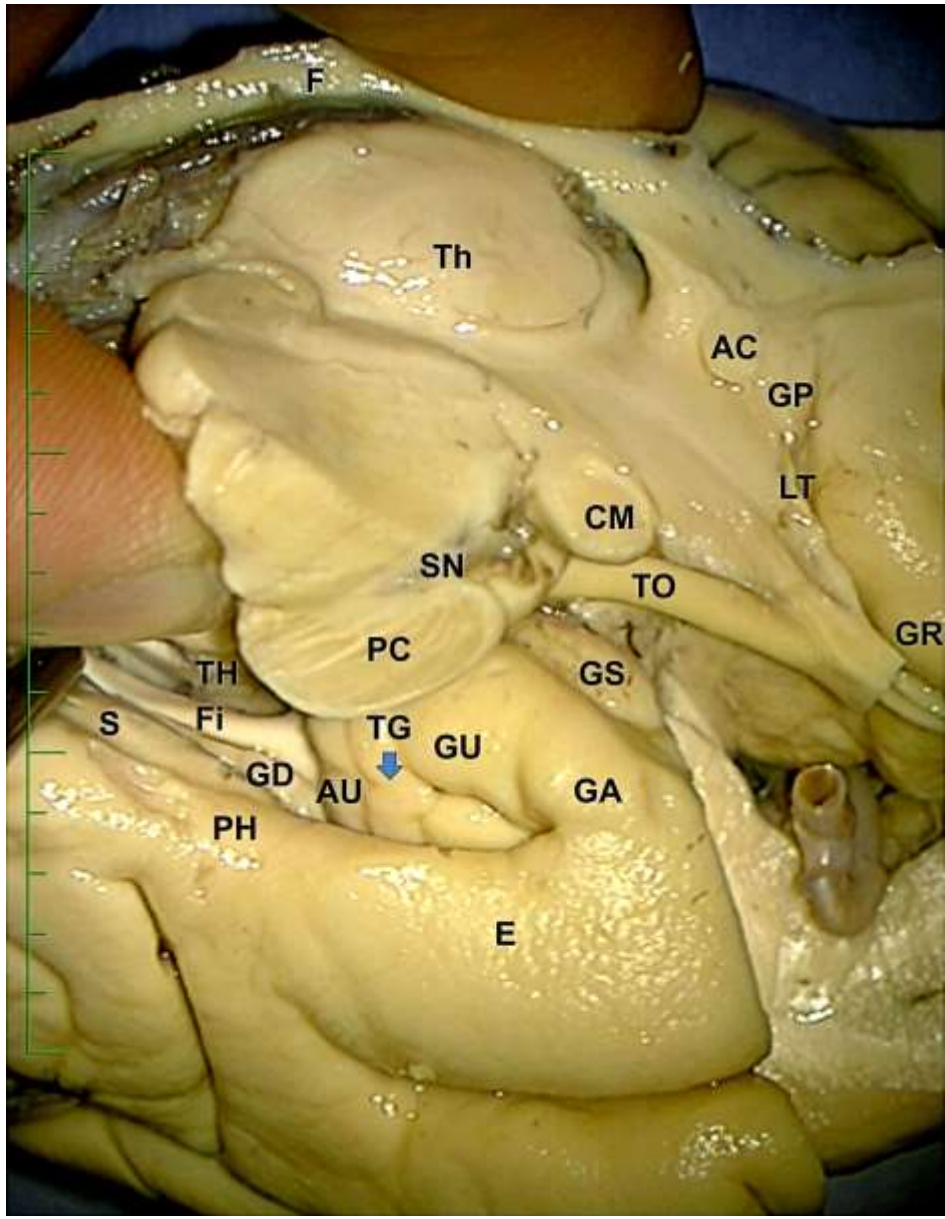
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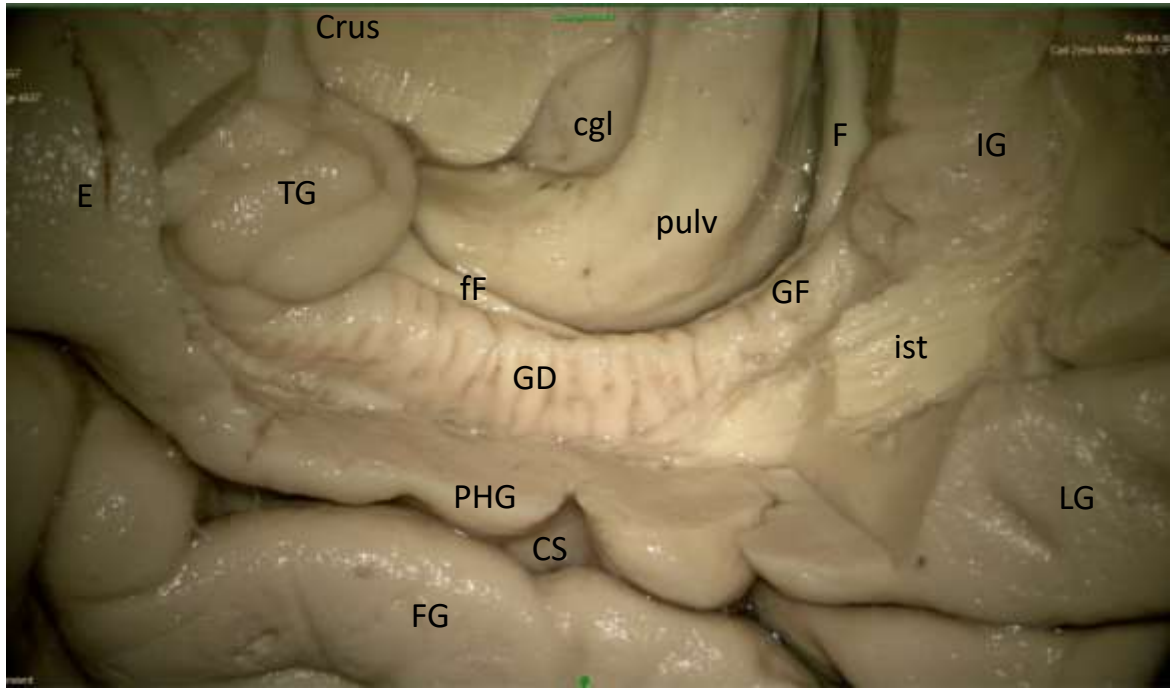
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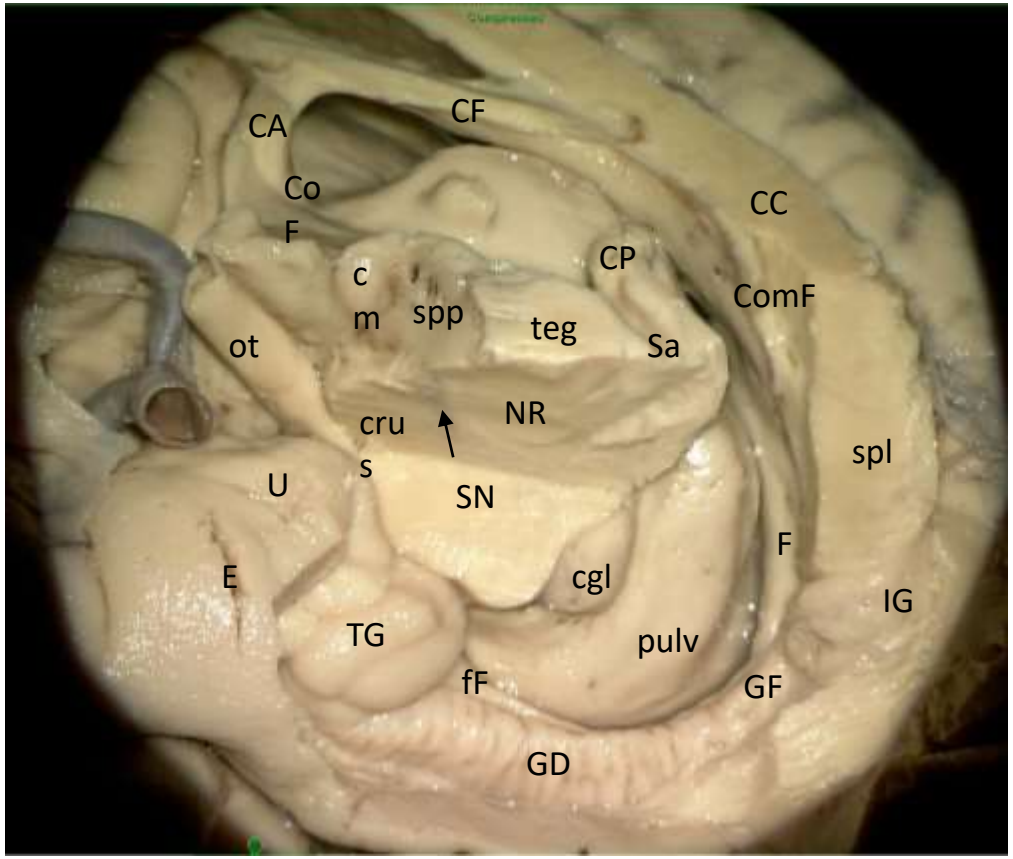
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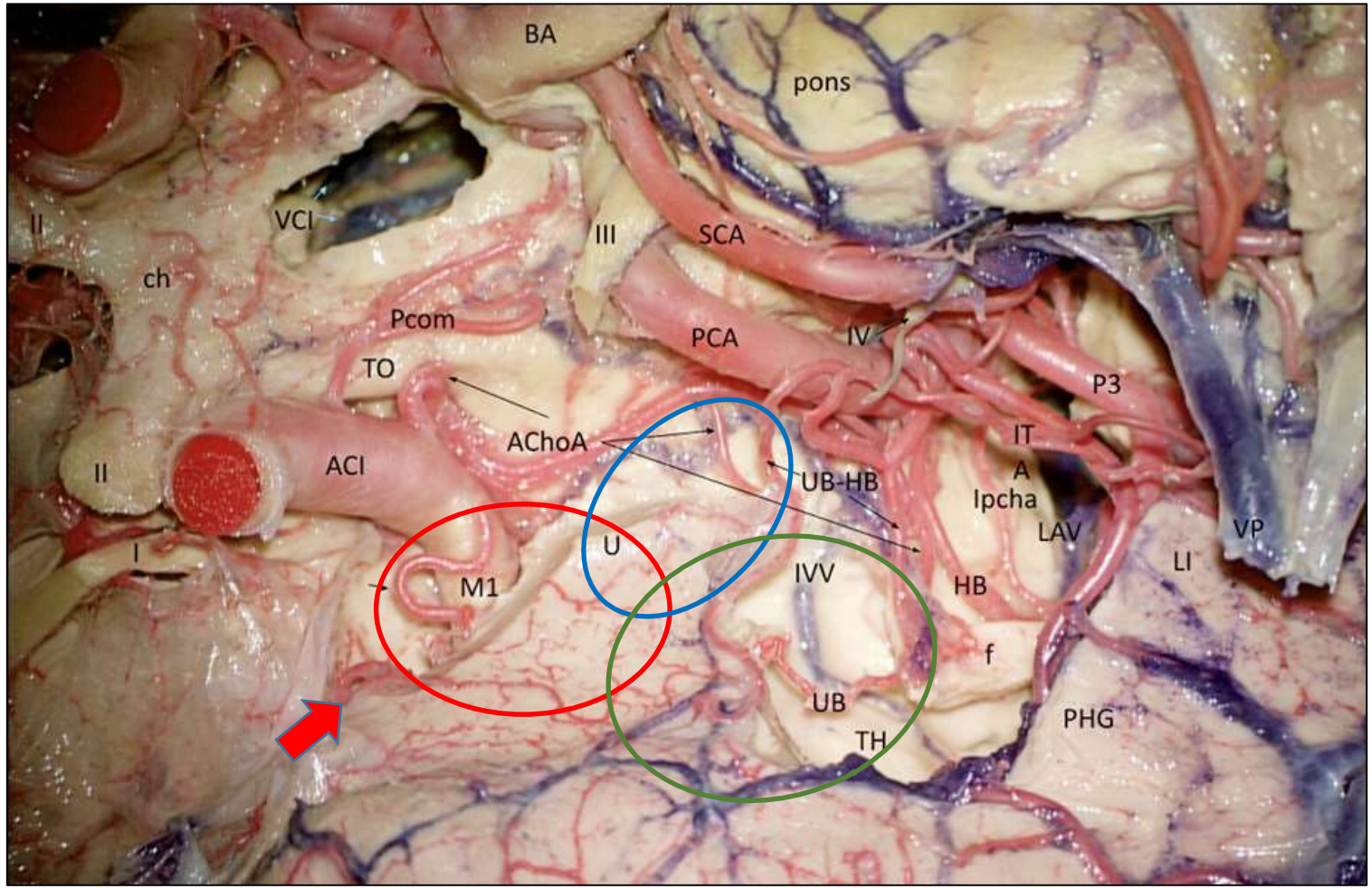


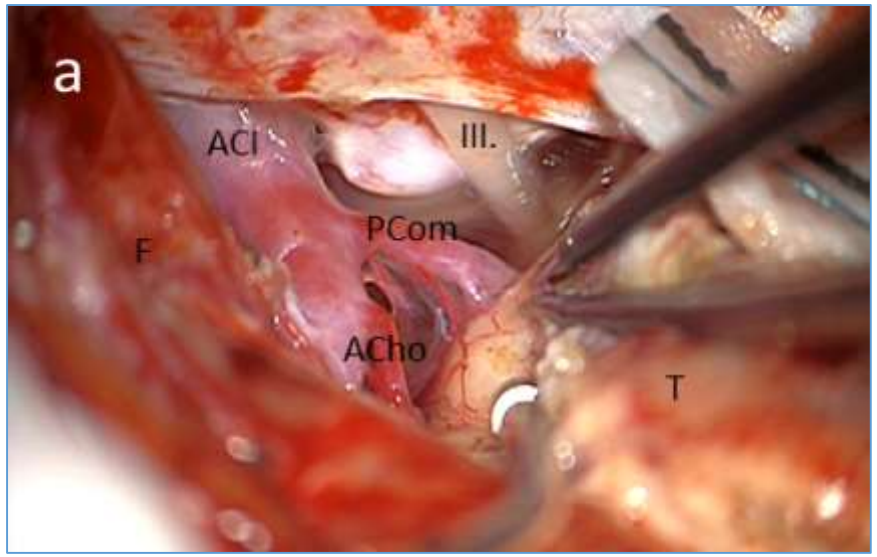
Vascular supply of the uncus:

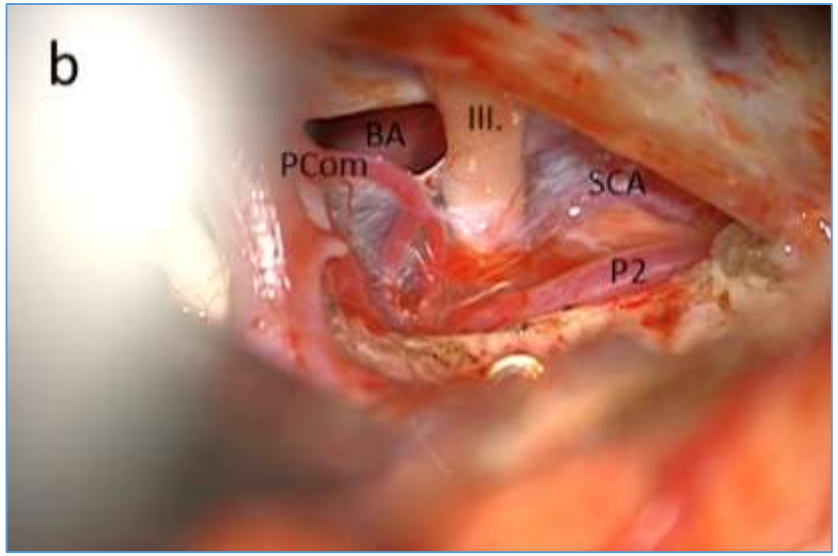
MCA : „uncal branch“

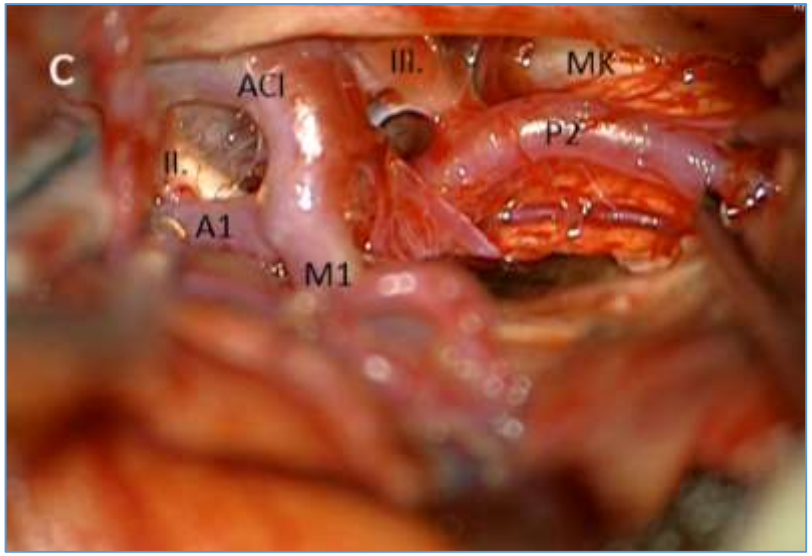
AChoA: „unco-hippocampal branch“

PCA: „anterior unco-parahippocampal artery“

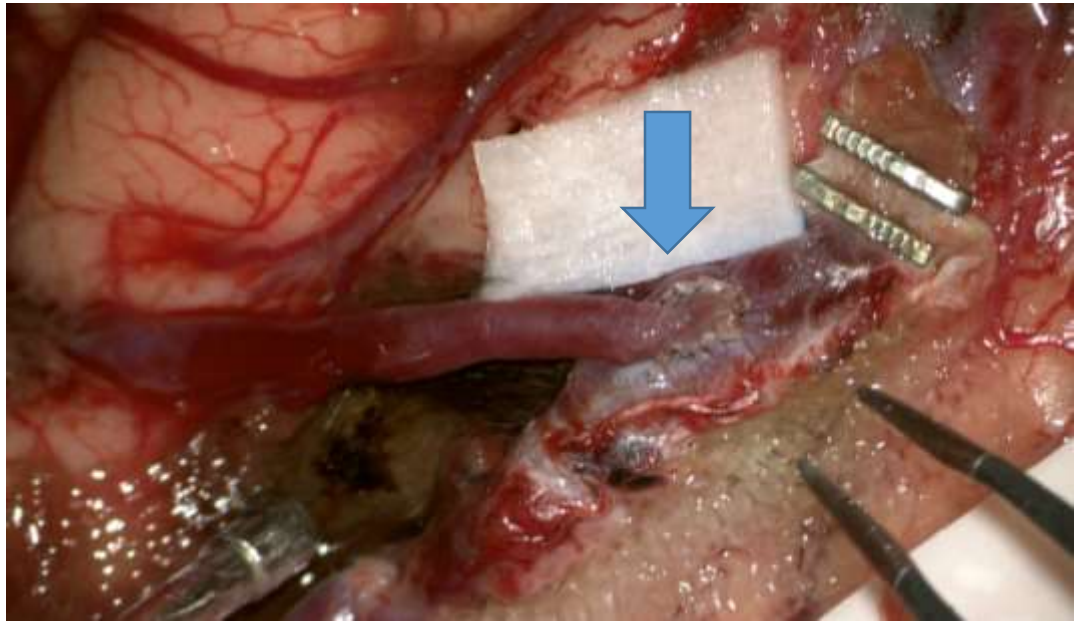
Amygdalo-hippocampectomy - conventional transsylvian approach

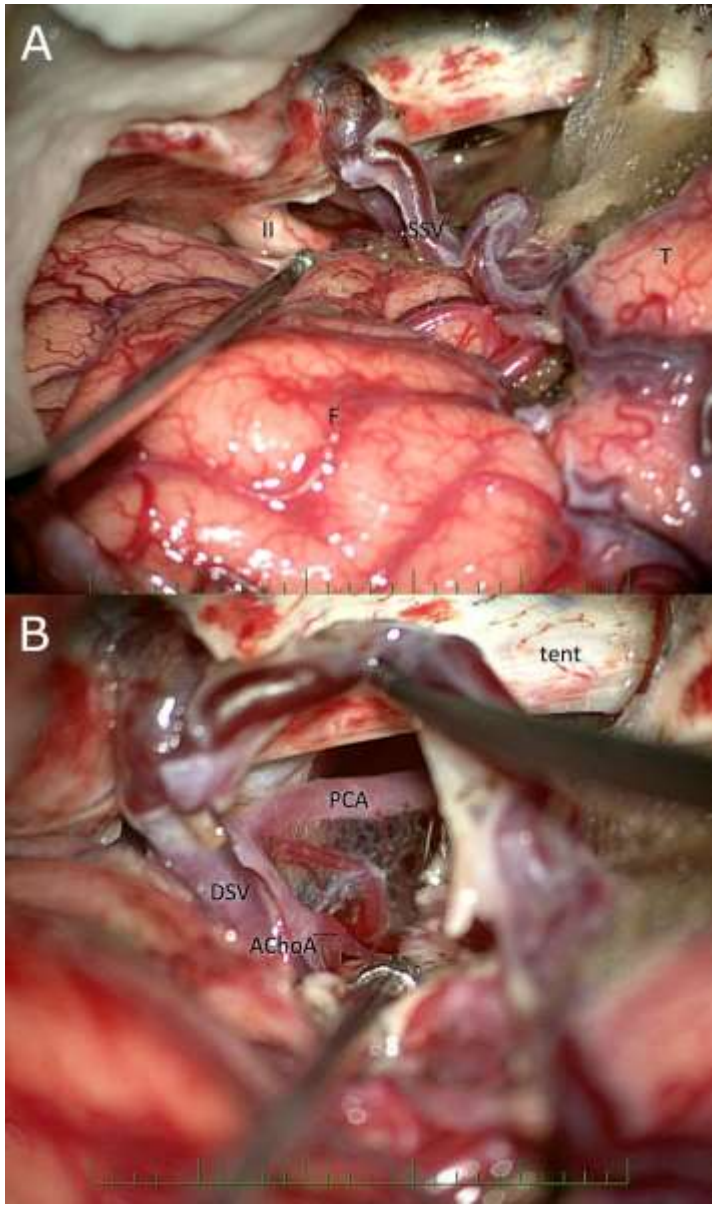






Veins in neurosurgery – transsylvian approach: superficial and deep sylvian vein (one of the anastomotic veins)





„When surgeon knows the anatomy and the surgical technique, he/she can use alternative approaches (with less invasivity, but technically more challenging).“

Kombinovaný paramediánní supracerebellární-transtentoriální a miniinvazivní subokcipitální přístup při resekci gliomu celé délky mediobazální temporální oblasti

Combined Paramedian Supracerebellar-transtentorial and Miniinvasive Suboccipital Approach to the Entire Length of the Mediobasal Temporal Region Glioma

Souhrn

V krátkém sdělení prezentujeme kazuistiku 64letého pacienta s gliomem celé délky mediobazální temporální oblasti vpravo. Pro jeho resekci jsme zvolili paramediánní supracerebellární-transtentoriální přístup, který jsme museli doplnit minimálně invazivním subokcipitálním přístupem. Popisujeme anatomický aspekt, chirurgické detaily a limity tohoto elegantního přístupu k mediobazální temporální oblasti, častému cíli onkoneurochirurgických a epileptochirurgických výkonů.

Abstract

In a short communication, we describe a case of a 64 years old patient suffering from glioma of the entire length of the mediobasal temporal area of the right hemisphere. For its resection, we have selected paramedian supracerebellar-transtentorial approach that had to be supplemented with the minimally invasive suboccipital approach. We discuss an anatomical aspect, surgical details and limits of this elegant approach to the mediobasal temporal area, the frequent target of cancer and epilepsy surgeries.

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Přijato do tisku: 22. 1. 2014

Klíčová slova
mozkový gliom – epilepsie – hipokampus – temporální lalok

Key words
brain glioma – epilepsy – hippocampus – temporal lobe

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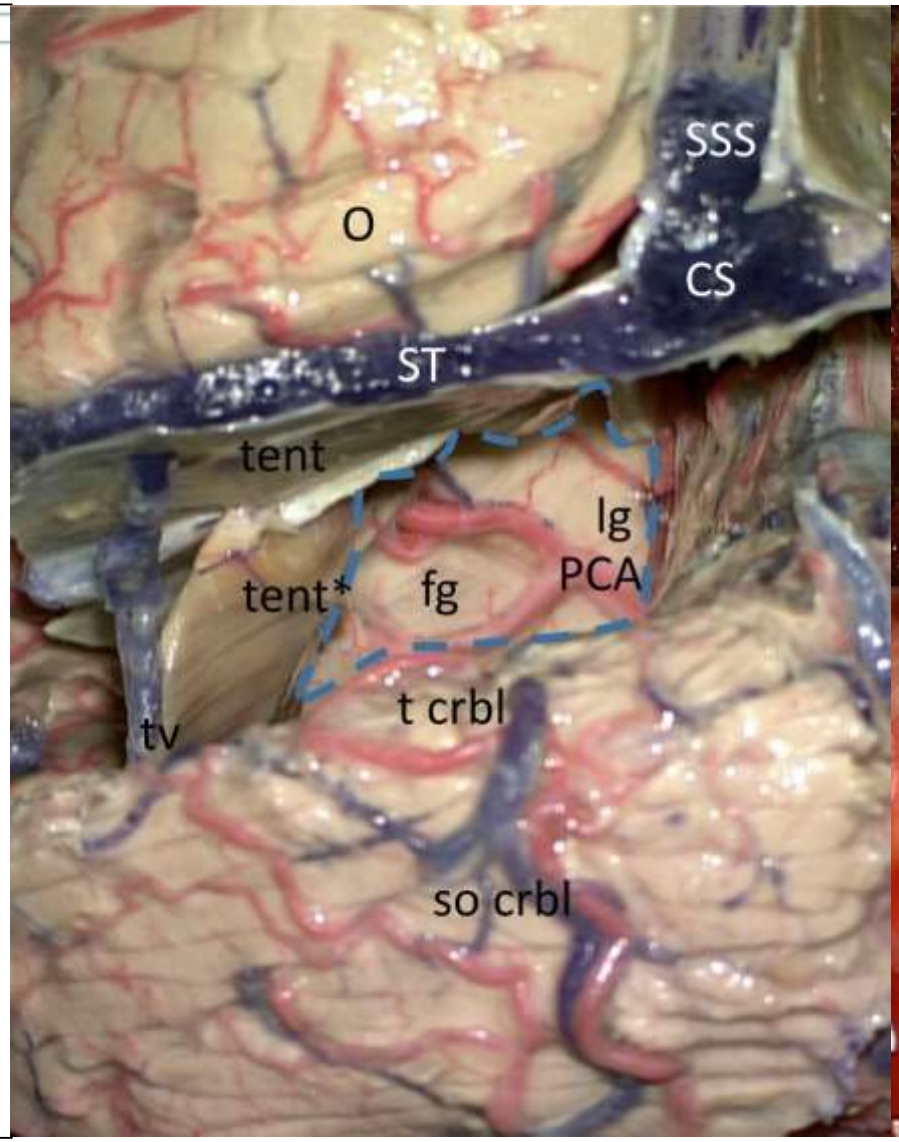
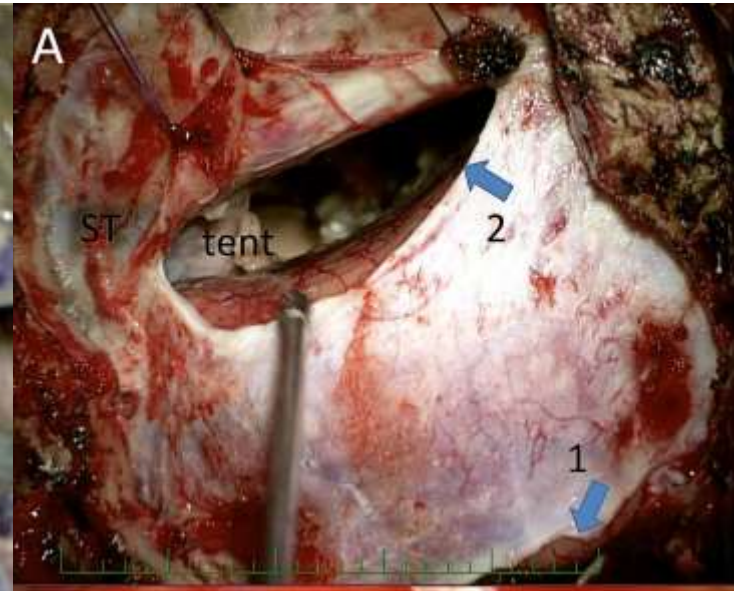
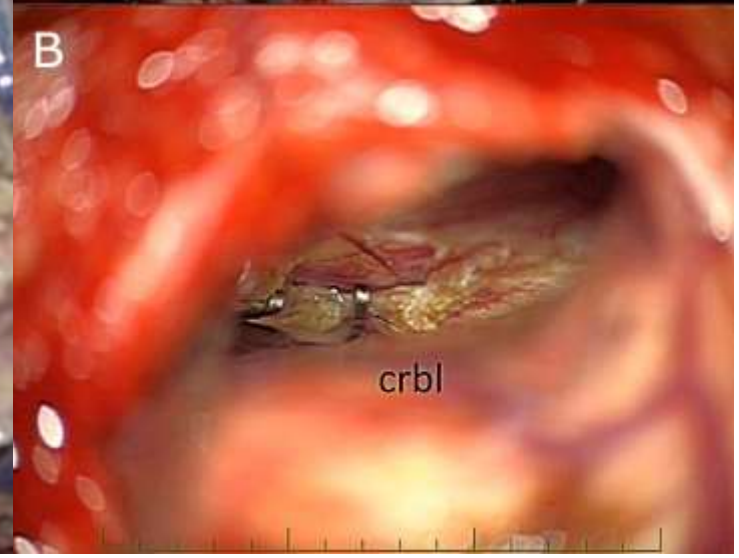
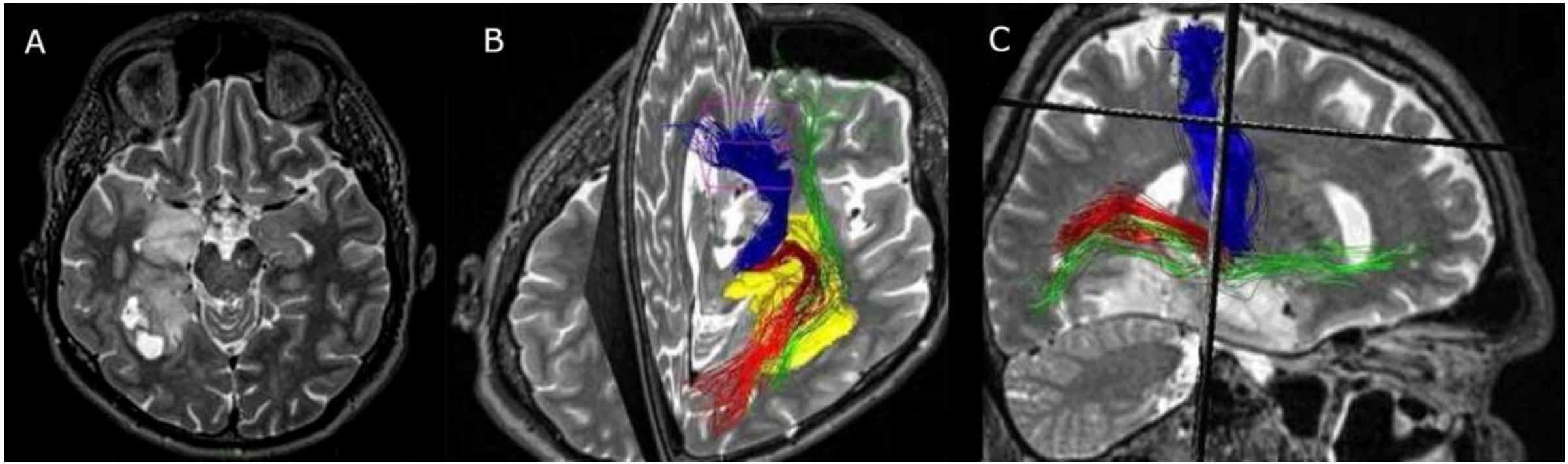
Poděkování: prof. H. Bertalanffymu za motivaci k provedení operace a vysvětlení technických detailů během návštěvy v Ústí nad Labem 27. 11. 2013.








A
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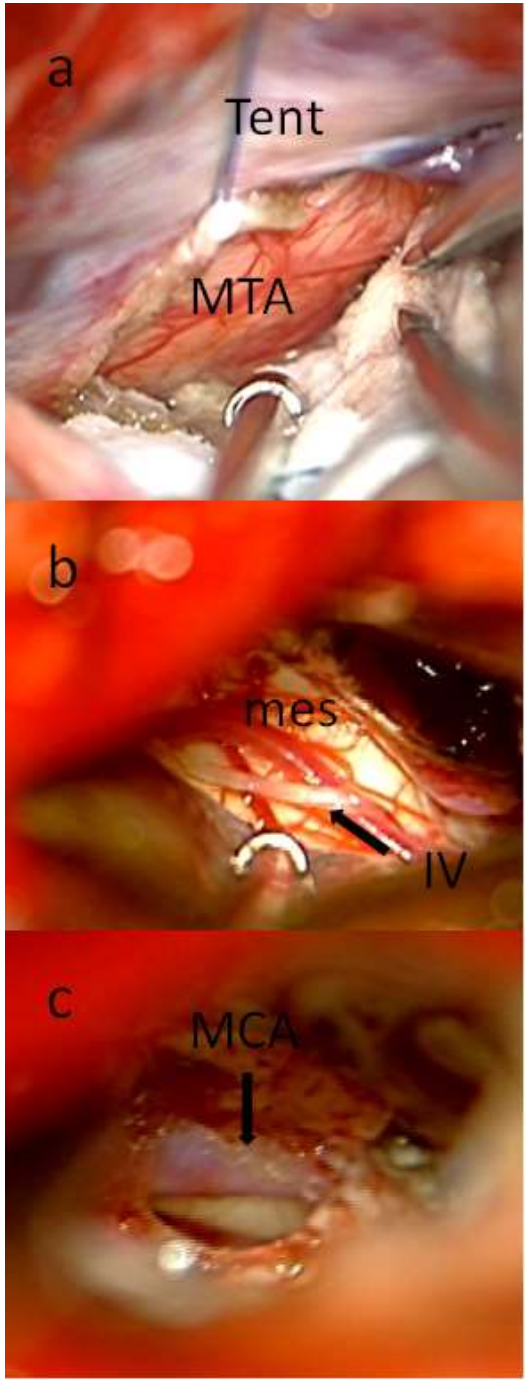
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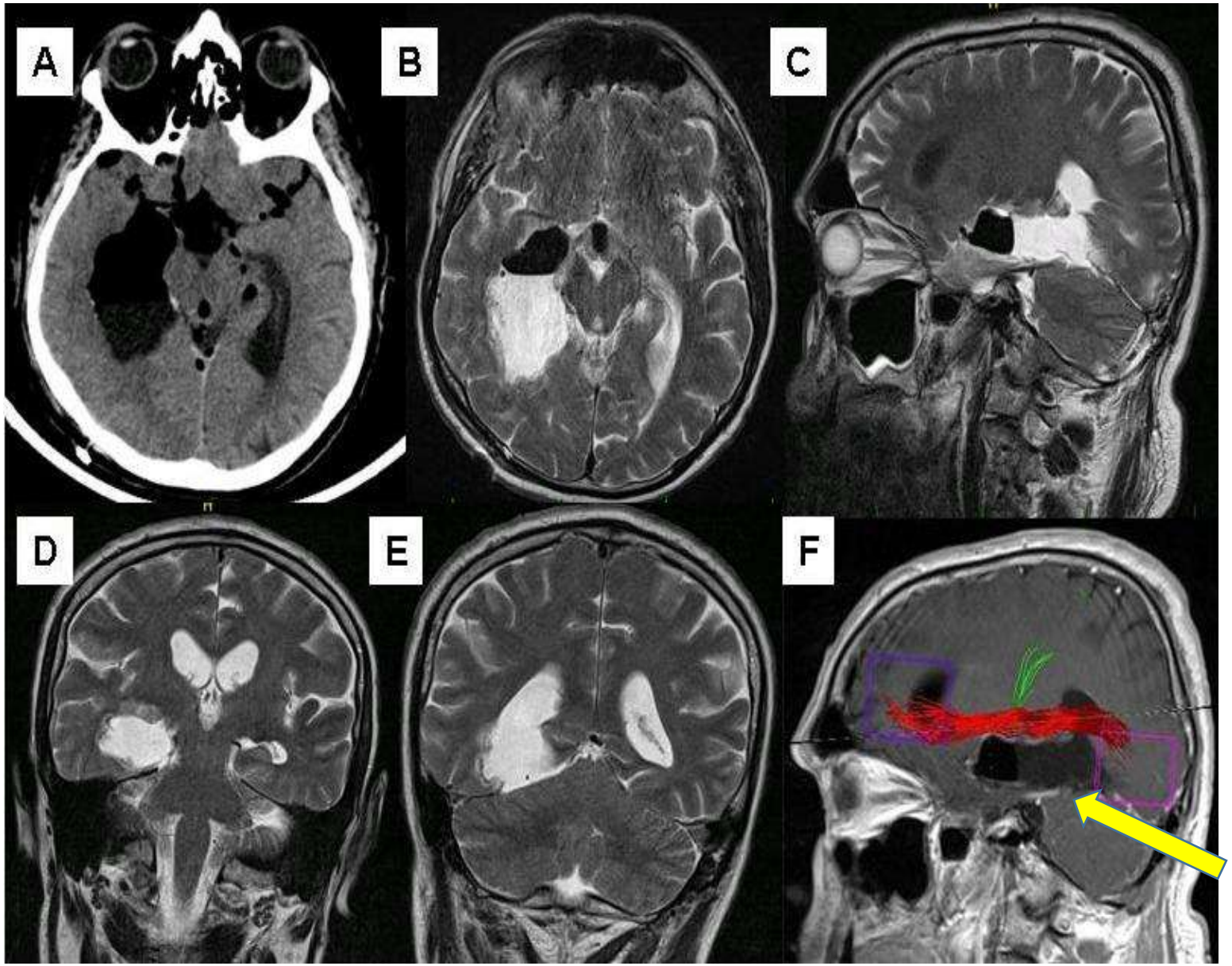
A
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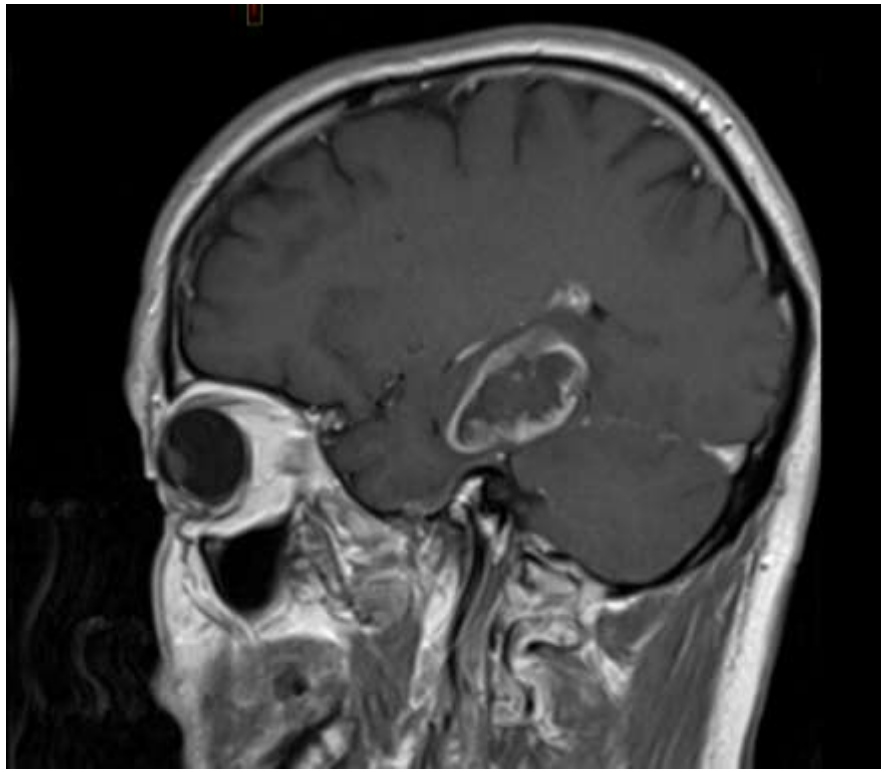
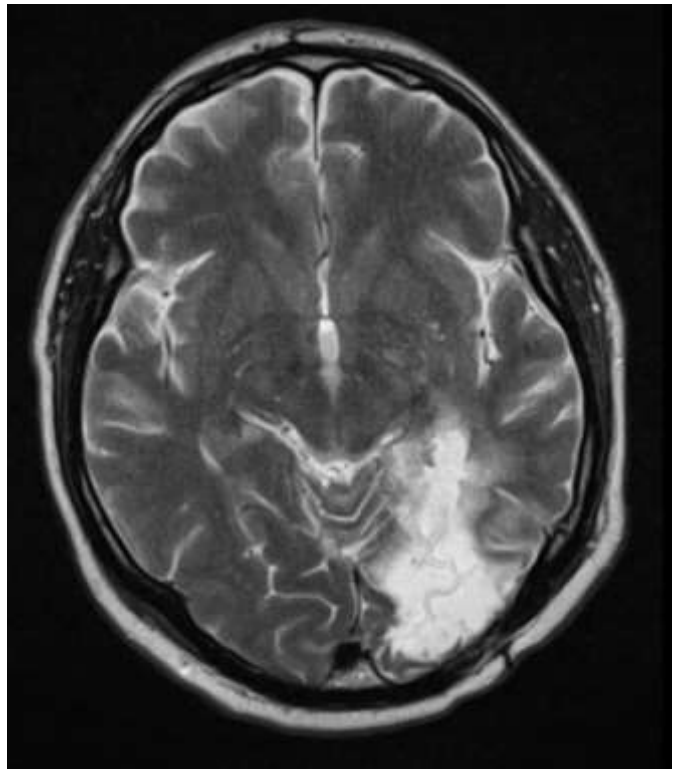
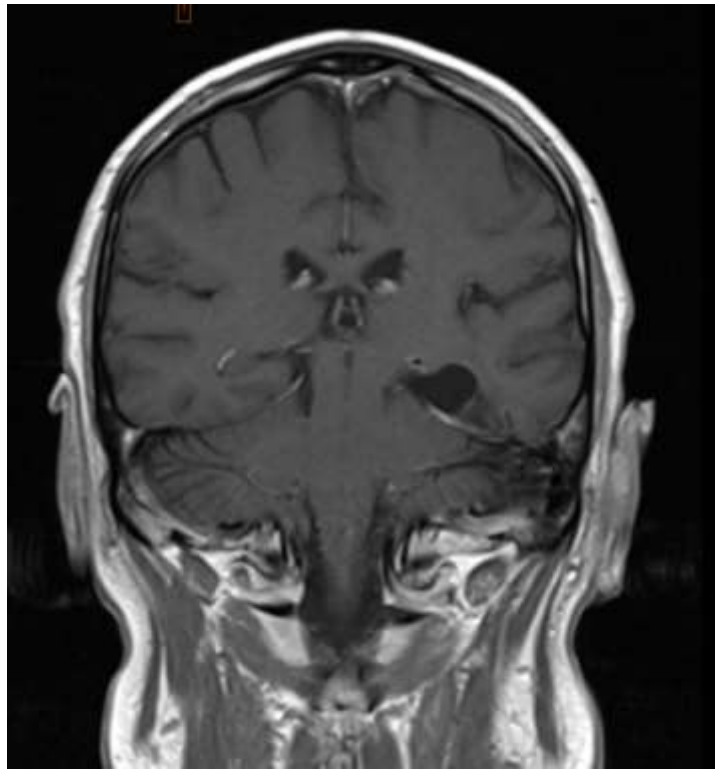
hippocampectomy: 1 x lesion of PCA during PIHA, 1 x lesion of PCA during SCTTA in GBM – posterior cerebral artery was involved in the tumour

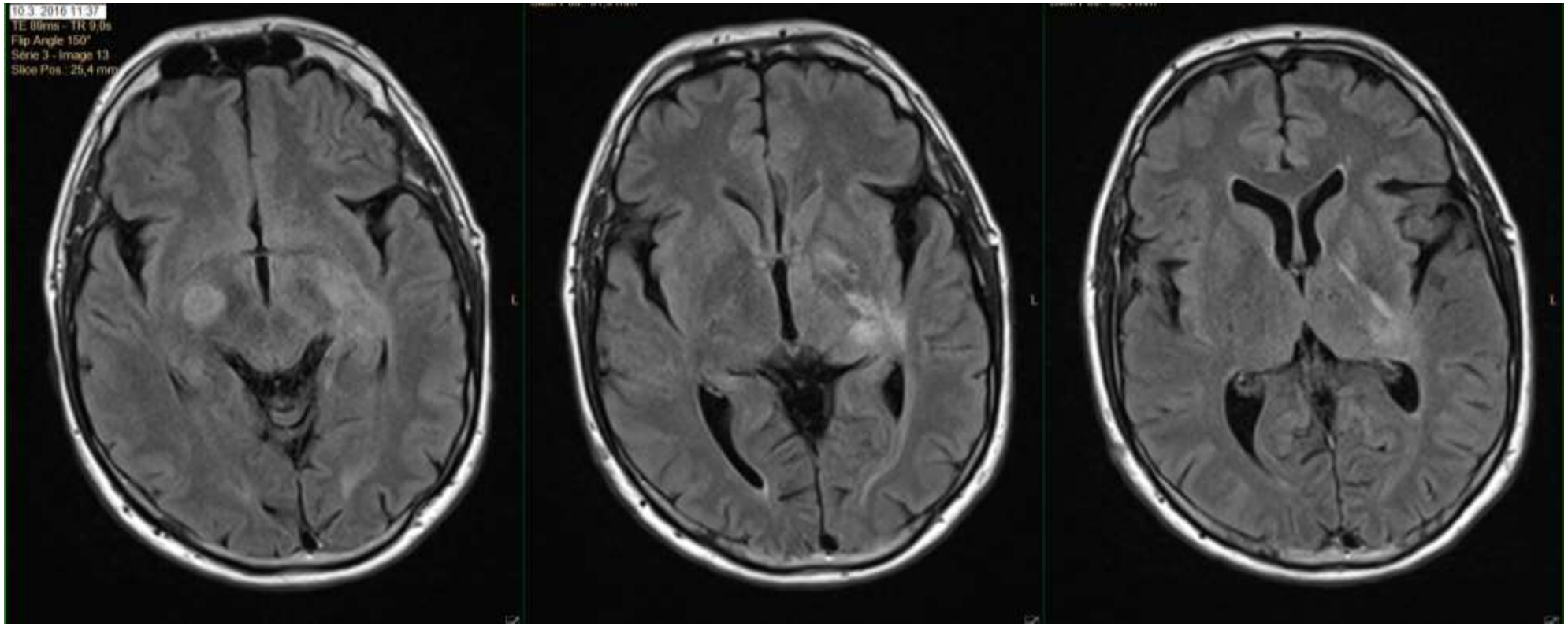
1 year after surgery



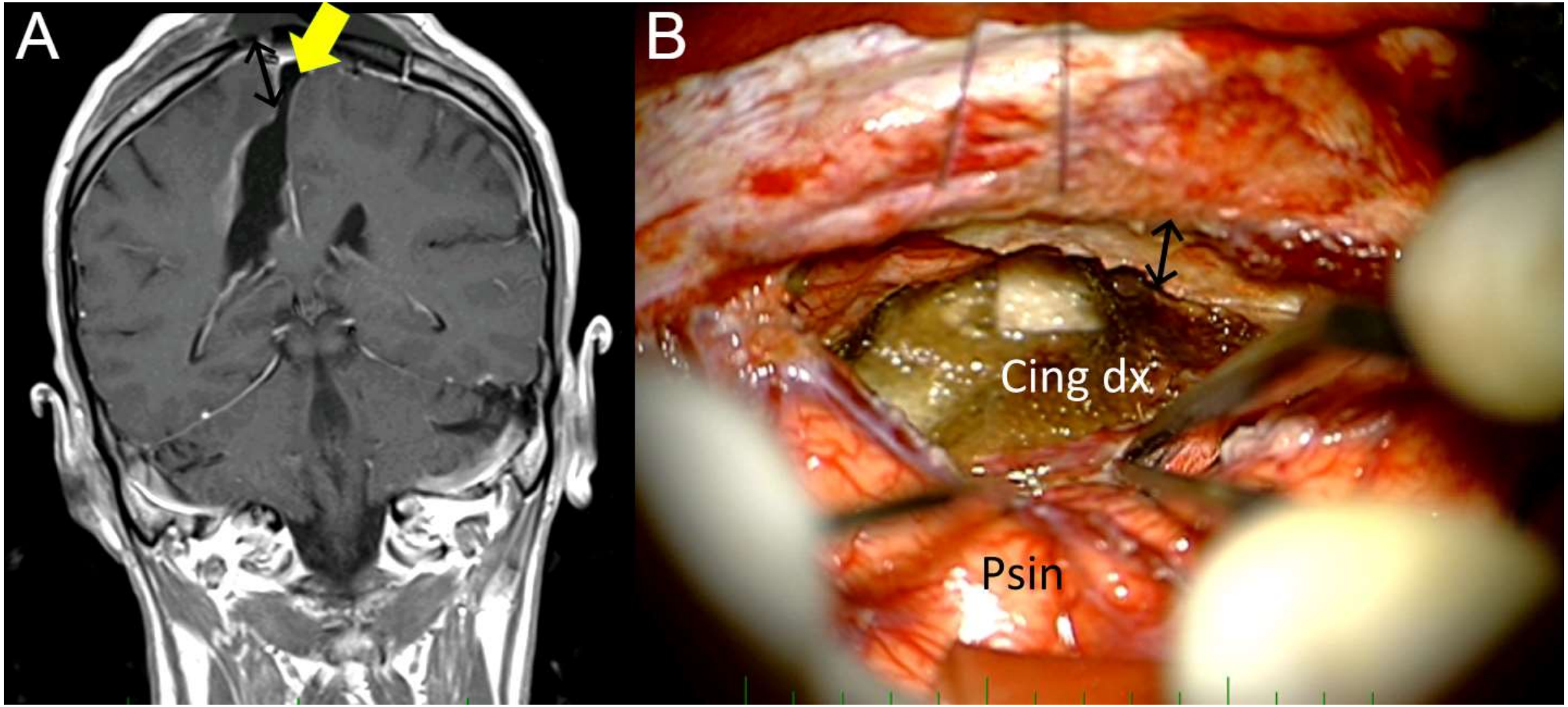


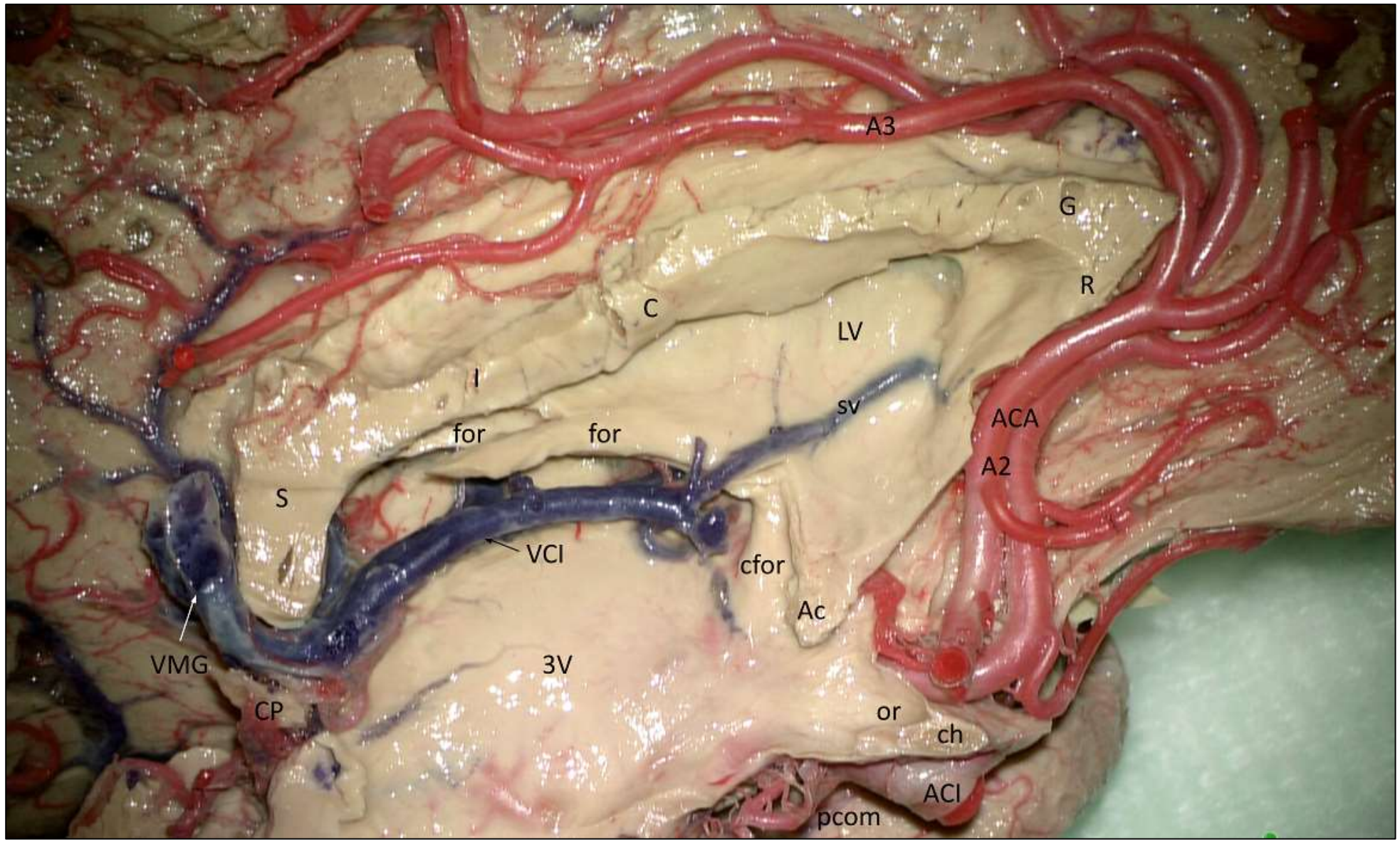


Both-side lesion of the hippocampus resp. corpus geniculatum laterale



Cingulum – interhemispheric approach with transfalx variant

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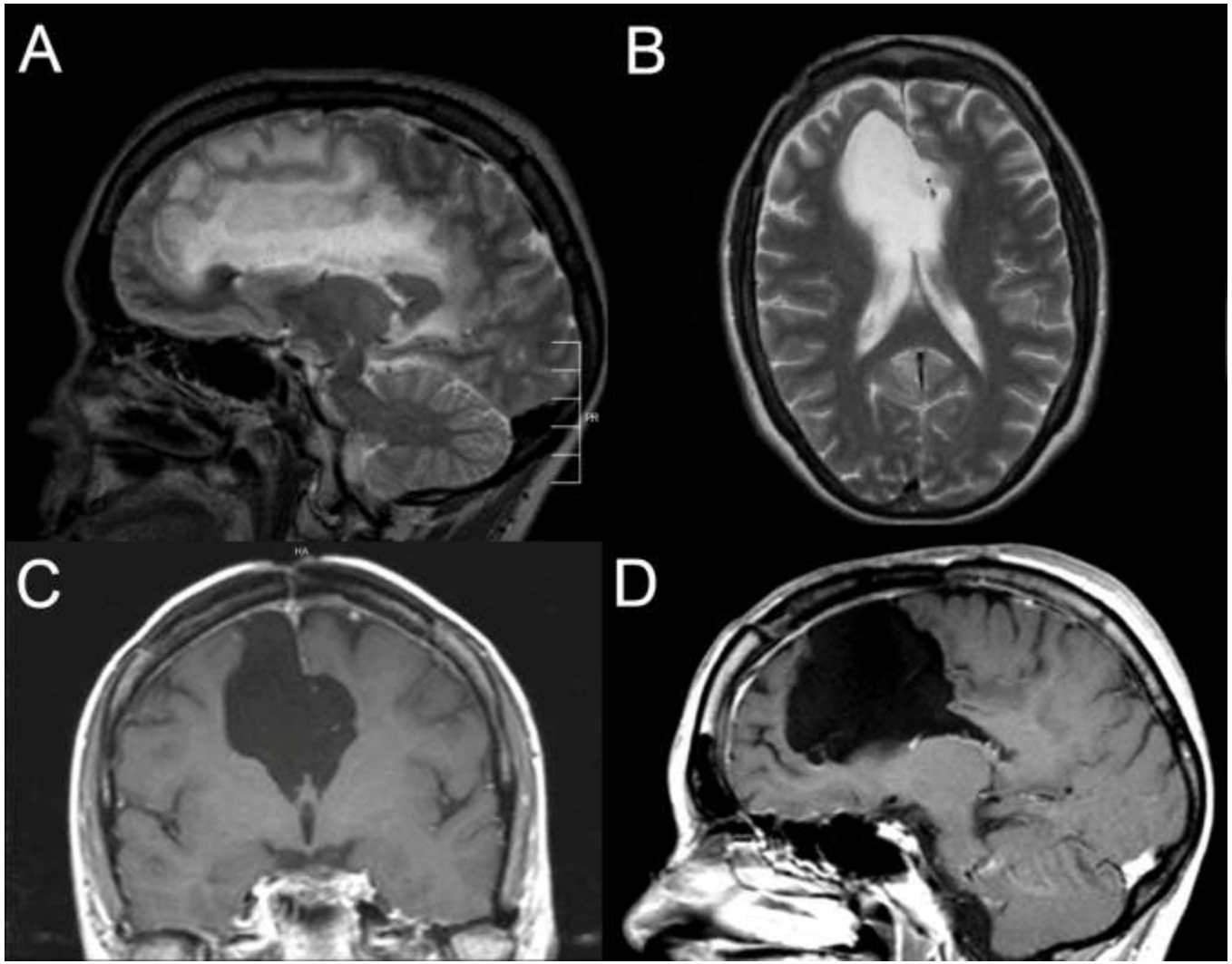
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ACA dx


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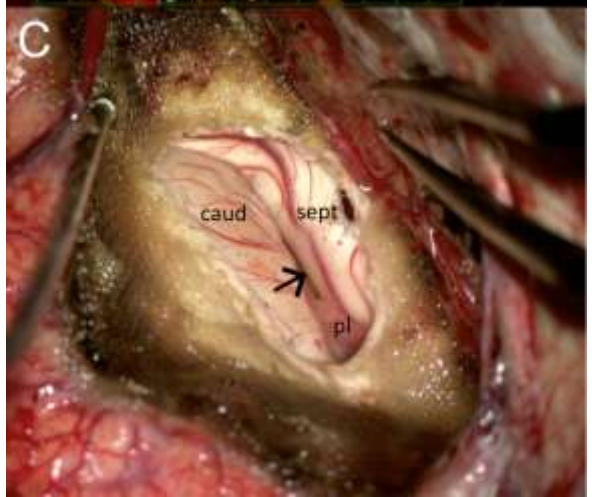
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U. Türe

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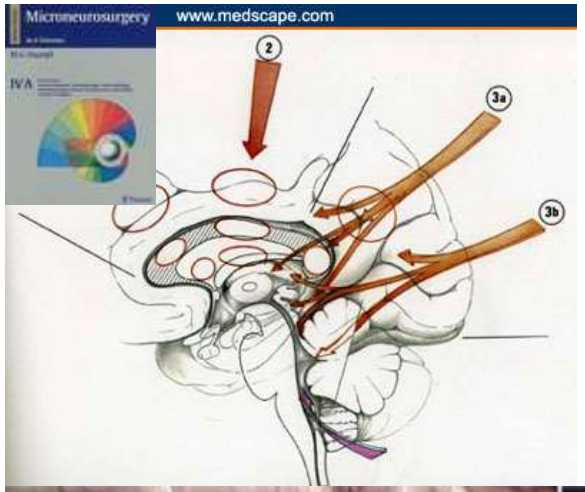
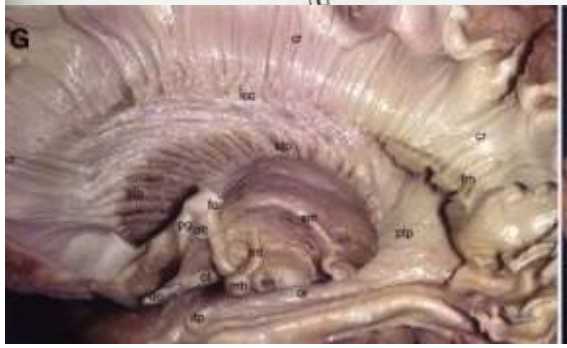
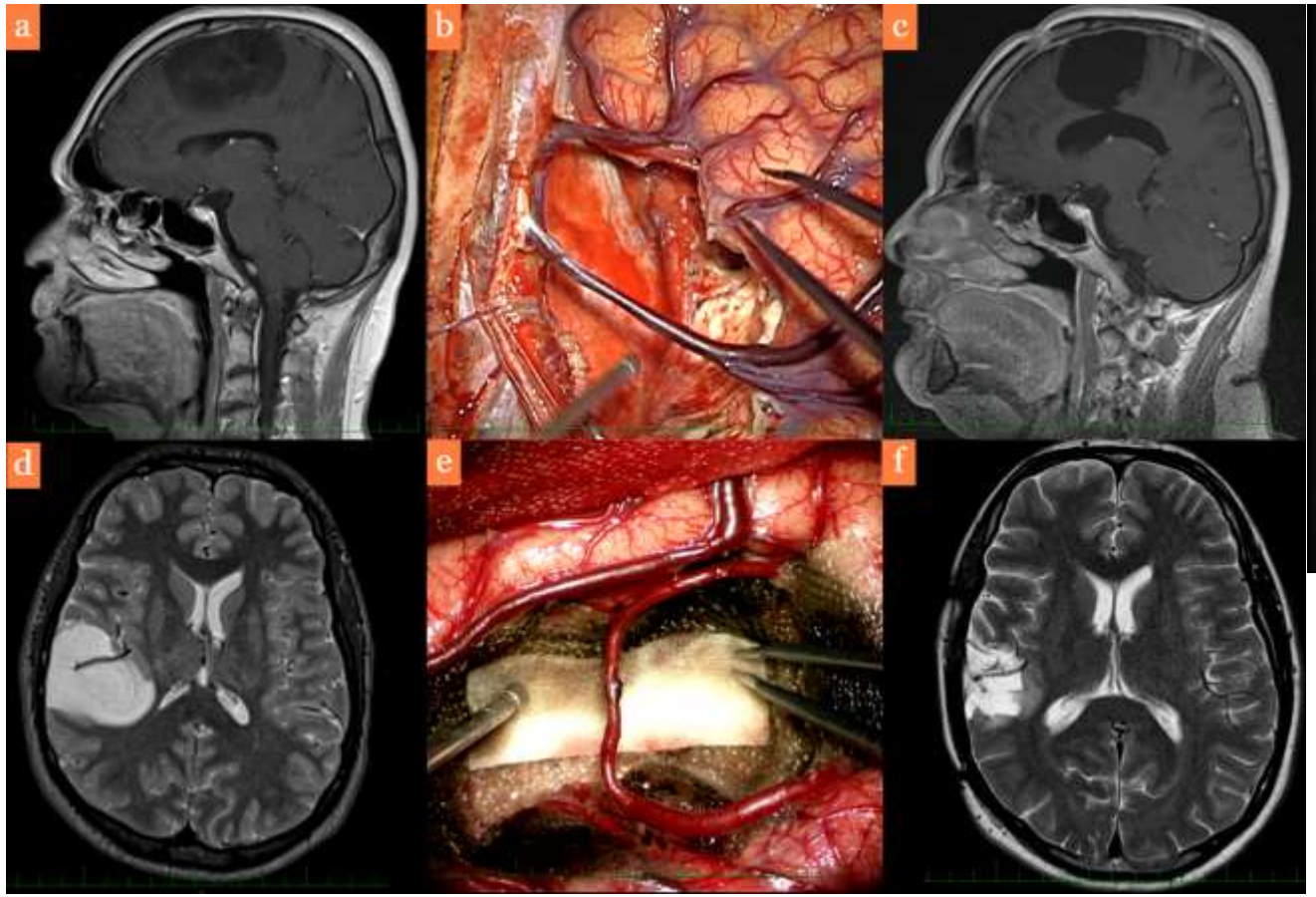


Knowledge
Skill
Carefulness
Patience
Humility
Compassion

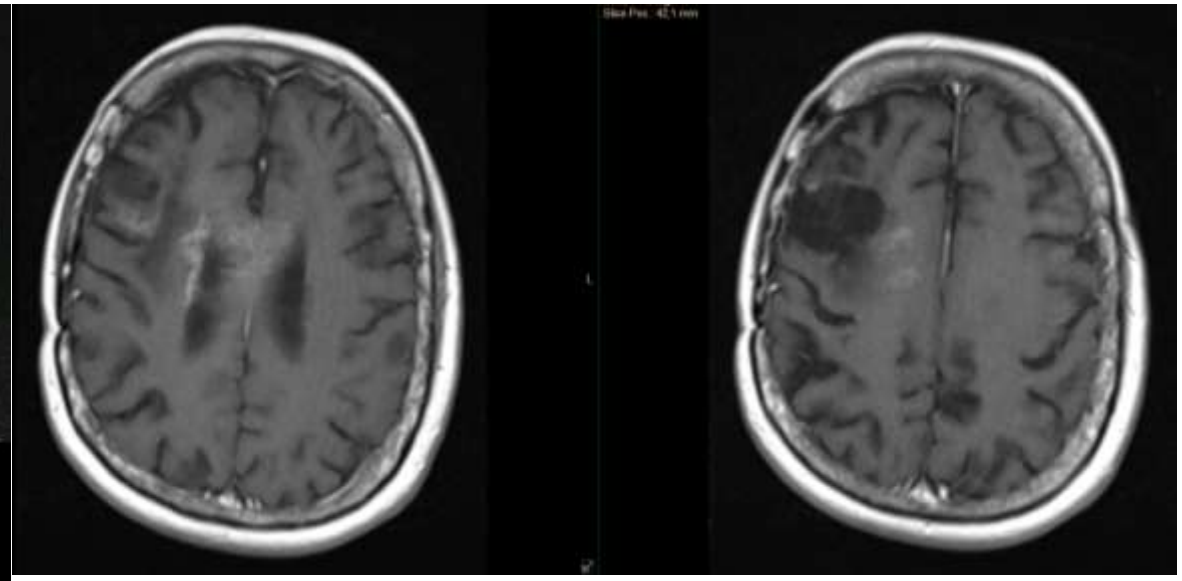


„Patient is in the 1st place.“
(indication, surgery, observation)

Surgery

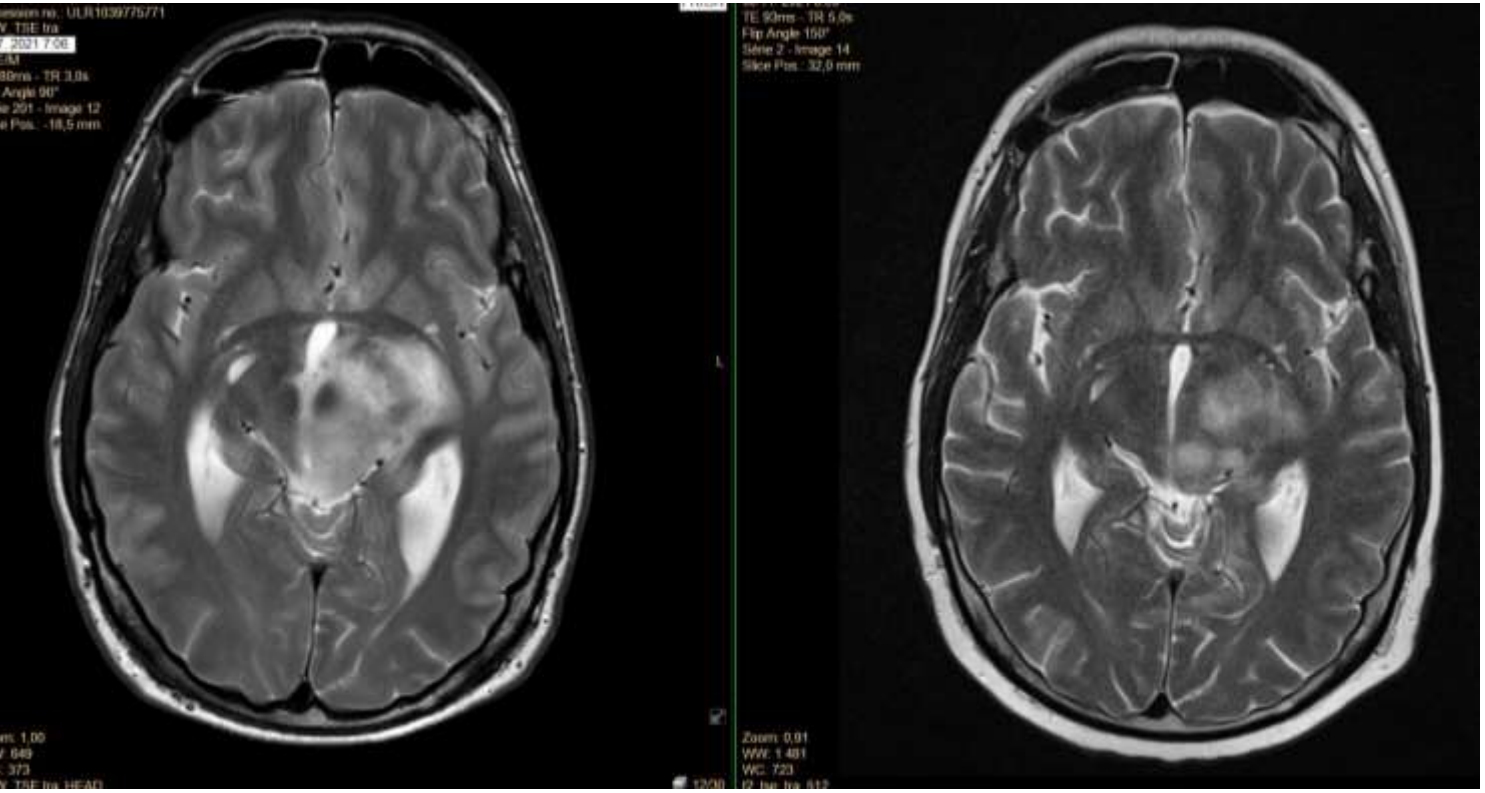


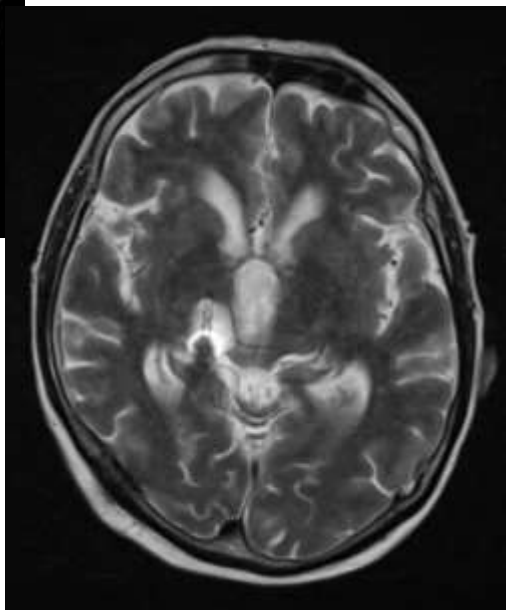
16 years after primary surgery and radiotherapy



„Patient is in the 1st place.“

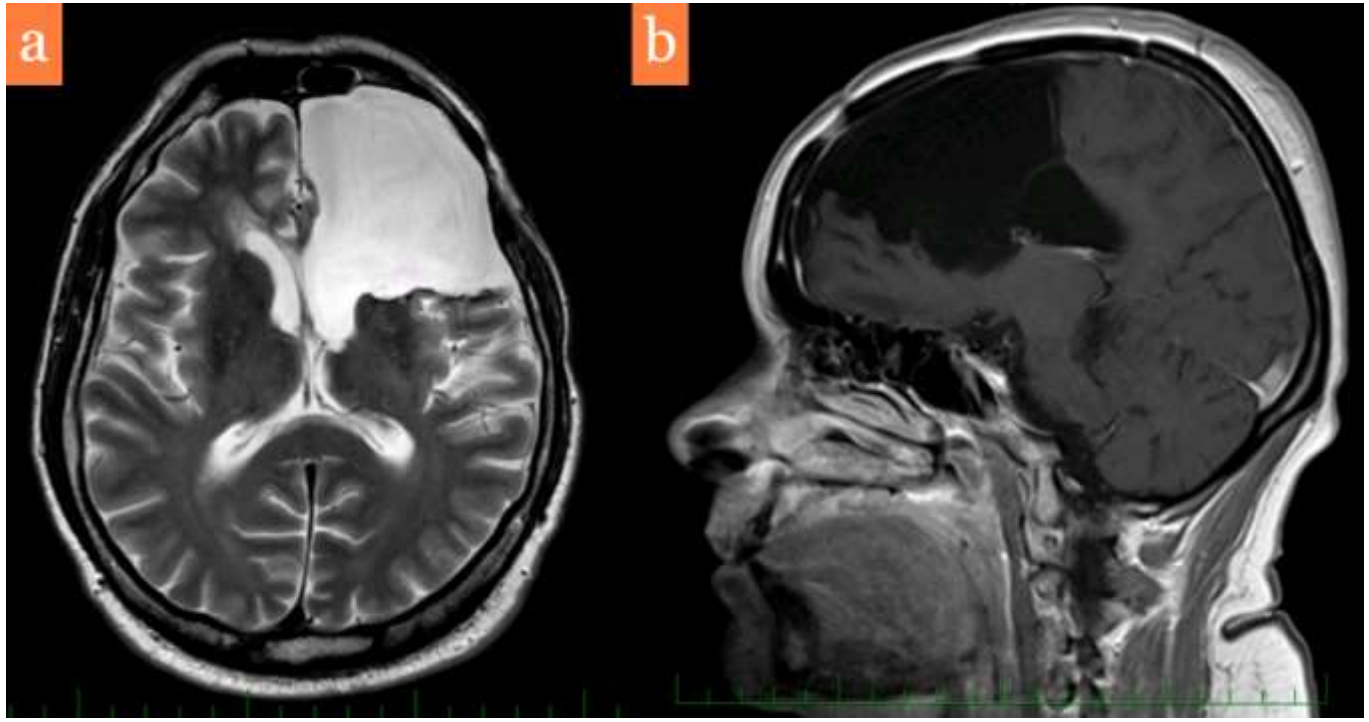
(individual and sometimes non-protocolar approach to the patient, oncologic treatment)





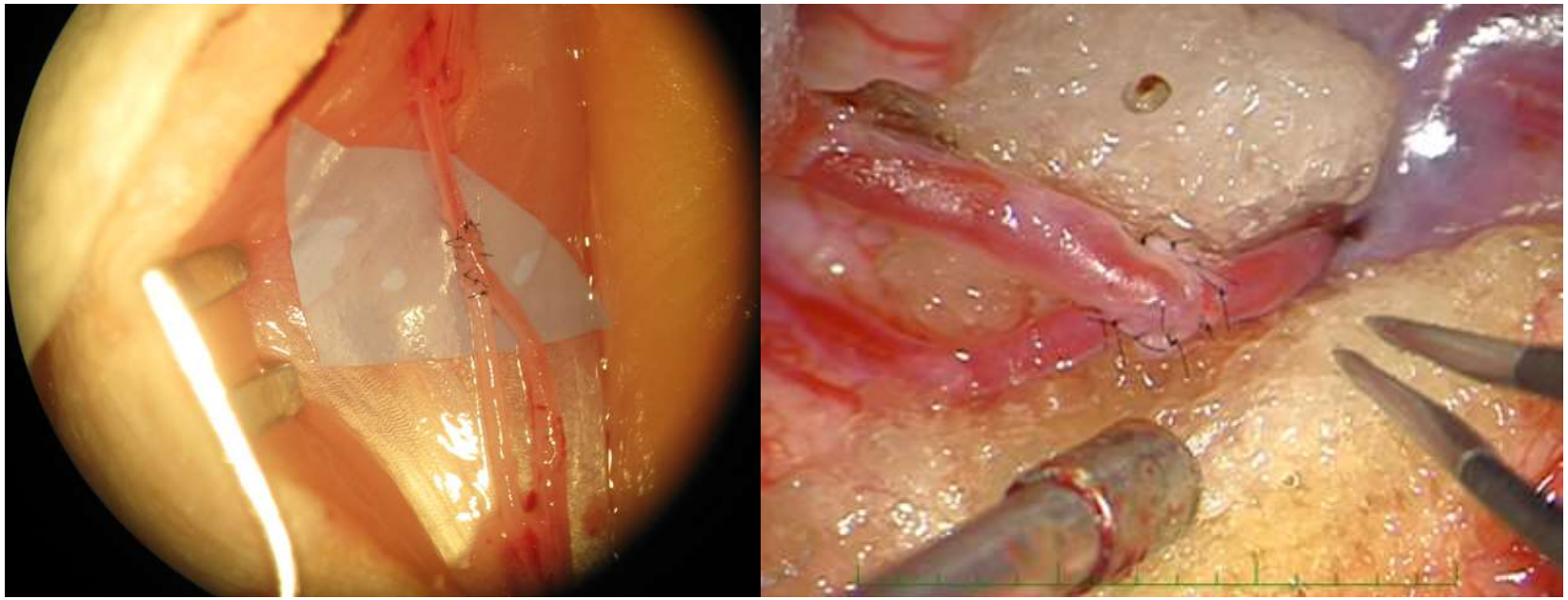
Komplexní léčba difuzních nízkostupňových gliomů – technika operování a onkologická léčba rezidua

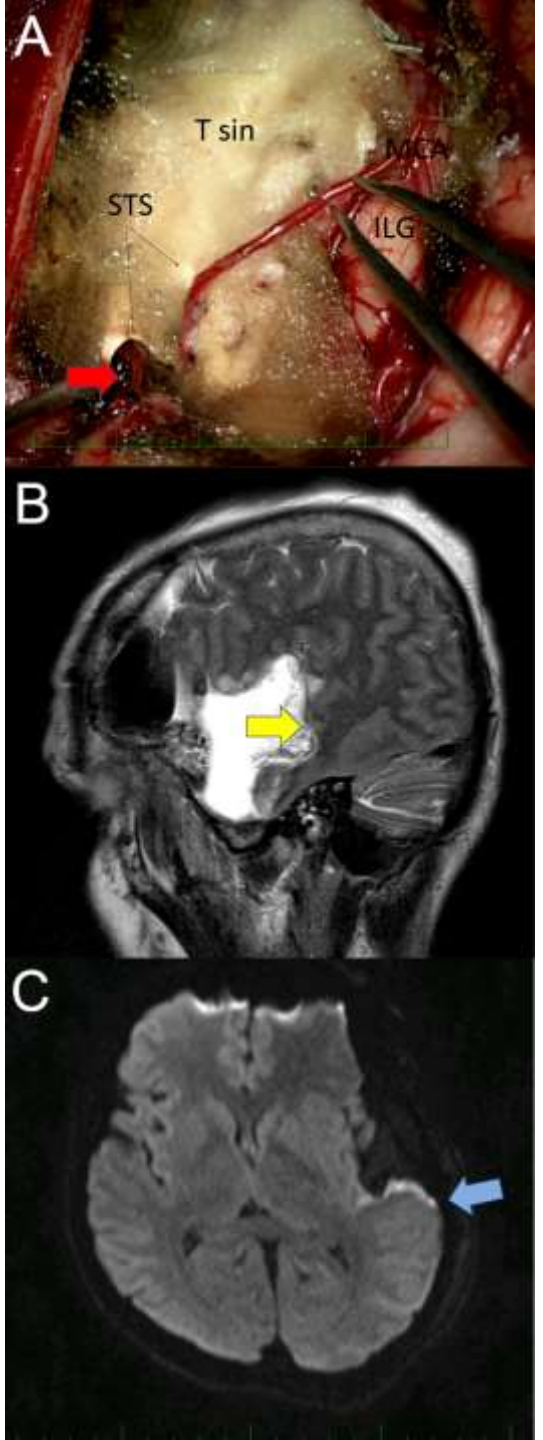
Complex treatment of diffuse low-grade glioma – surgery technique and oncological treatment of residual tumors



Before the surgery you must evaluate the racionality of your aim to be radical
and
evaluate the **ANATOMICAL and FUNCTIONAL** borders of the resection.

„To feel your surgical mistake and be able to **repair** it.“





Laboratory training, ability of the vascular microsuture and reconstruction

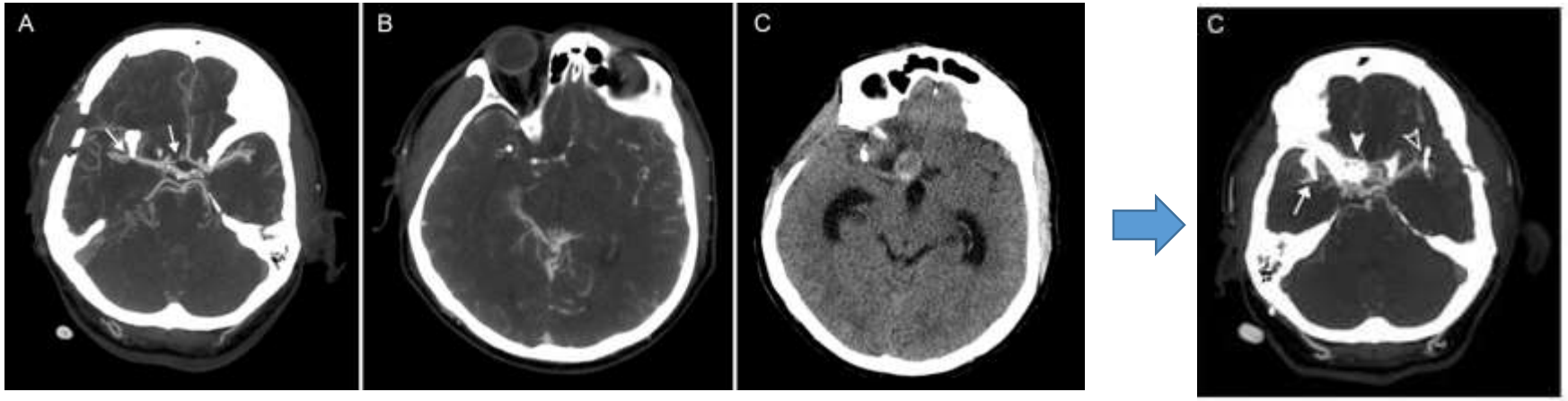
brain sciences

MDPI

Case Report

The Iatrogenic Development of an Anterior Cerebral Artery Pseudoaneurysm during Lamina Terminalis Fenestration–Genesis, Diagnosis and Therapy: Lessons Learned

Bartoš Robert [1,2], Lodin Jan [1], Hejčl Aleš [1,3,4,*], Sameš Martin [1] and Cihlář Filip [1]

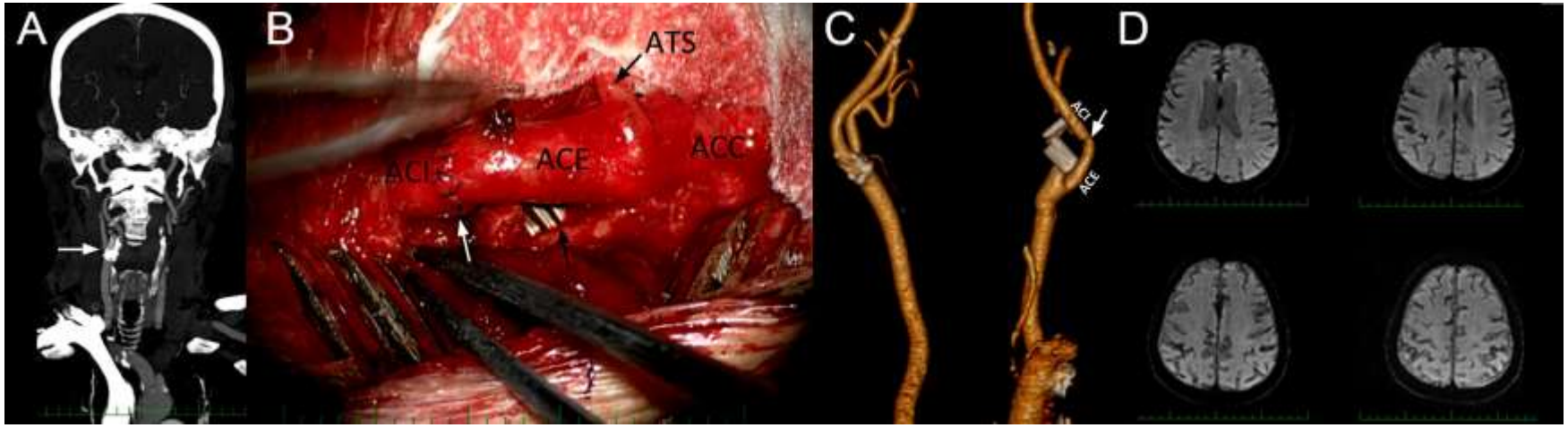


Routledge

Case Report

Rescue version of a carotid micro-endarterectomy: an ACE-ICA anastomosis with proximal Ica and distal ACE hemoclip obliteration

Robert Bartoš[a,b], Aleš Hejčl[a], Jan Lodin[a], Martin Sameš[a] and Tomas Marek[c,d]



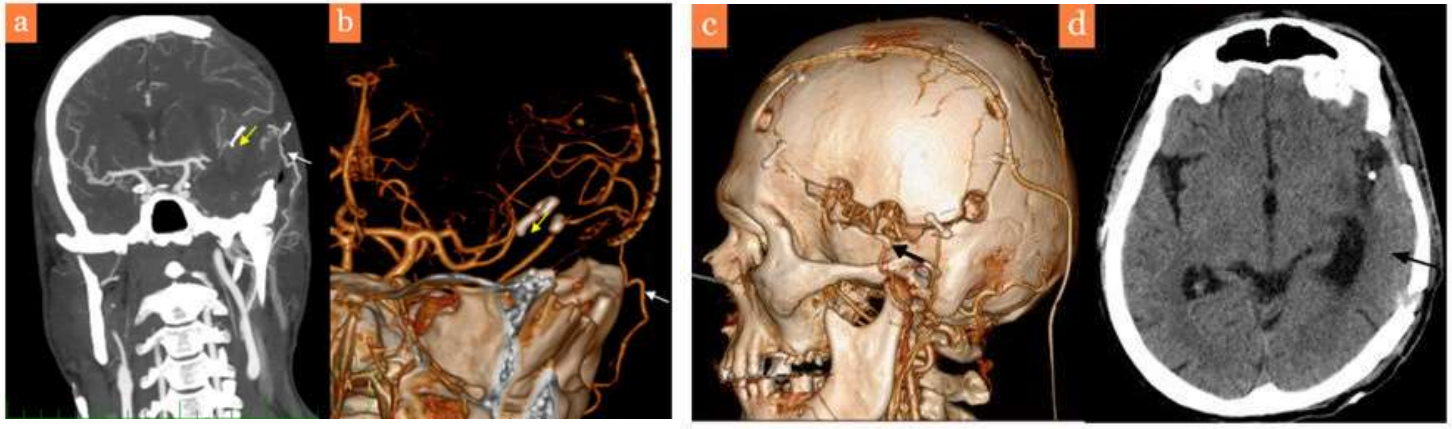
brain sciences

MDPI

Case Report

Bypass Procedure Performed in the Field of a Decompressive Craniectomy in the Case of an MCA Dissecting Aneurysm: Case Report and Review of the Literature

Robert Bartoš [1,2], Jan Lodin [1], Aleš Hejčl [1,3,4,*], Ivan Humhej [1], Ingrid Concepción [1,5], Filip Cihlář [6] and Martin Sameš [1]



INTERNATIONAL JOURNAL OF NEUROSCIENCE
https://doi.org/10.1080/00207454.2020.1819267

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CASE REPORT

Check for updates

Combined treatment of a medulla oblongata hemangioblastoma via permanent cysto-cisternal drainage and (postponed) gamma knife radiosurgery: a case report and review of the literature

Robert Bartoš[a,b], Jan Lodin[a], Tomas Marek[c], Martin Sameš[a], Veronika Němcová[b] and Roman Liščák[d]

[a]Department of Neurosurgery, Masaryk Hospital, Ústí nad Labem, Czech Republic; [b]Department of Anatomy, First Faculty of Medicine, Charles University, Prague, Czech Republic; [c]Department of Neurosurgery, Mayo Clinic, Rochester, MN, USA; [d]Department of Stereotactic and Radiation Neurosurgery, Na Homolce Hospital, Prague, Czech Republic

ABSTRACT

Background: Hemangioblastomas are histologically benign tumors with a variable degree of morbidity and mortality based on various factors, including their anatomical location. The following paper illustrates a unique approach of combined therapy of a brainstem hemangioblastoma (HB) not associated with von Hippel-Lindau disease (vHLd) located in the medulla oblongata.

Case description: A 21-year-old preschool teacher presented with vertigo, followed by dysphagia, trouble coughing, tongue paresis and headache and vomiting. Magnetic resonance imaging (MRI) revealed a large cystic lesion with a small intramural nodule located in the left anterolateral medulla oblongata directly behind the vertebral artery. The diagnosis of hemangioblastoma was supported by digital subtraction angiography.

Conclusion: Combined therapy consisted primarily of acute surgical fenestration and permanent drainage of the cystic portion of the tumor, due to symptomatic expansion. Follow-up stereotactic gamma knife radiosurgery was performed after 2 years for minor progression of the tumor nodule. To the best of our knowledge, this is the first time such approach has been described in the literature for this pathology.

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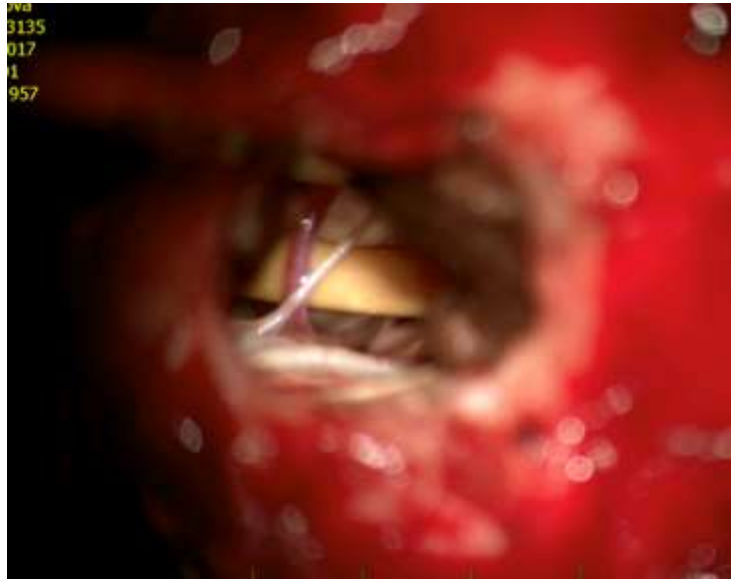
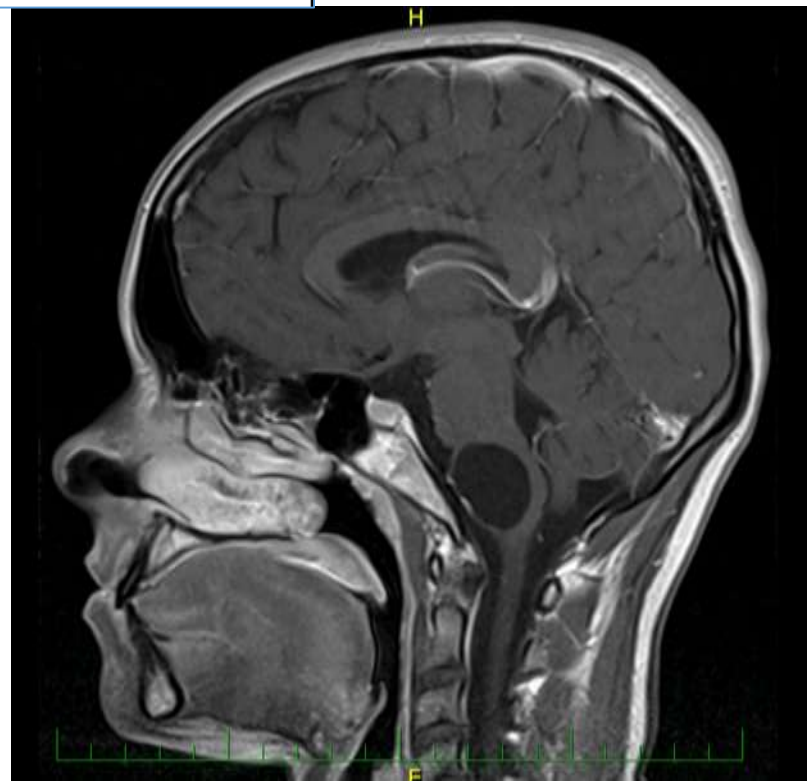
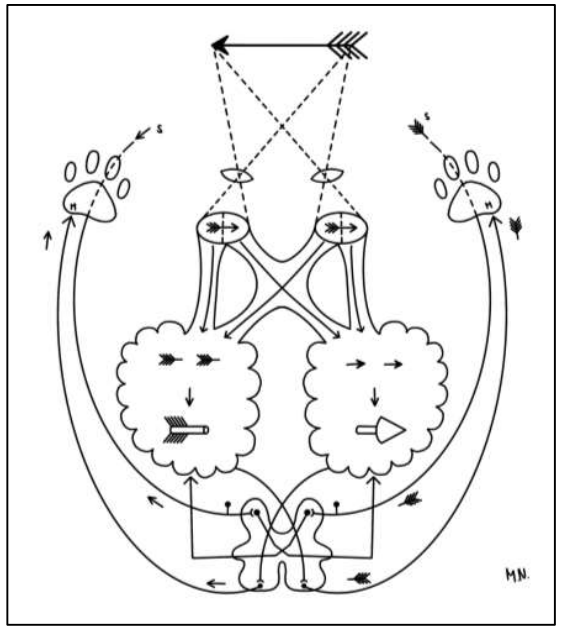
KEYWORDS
Hemangioblastoma; medulla oblongata; surgical treatment; radiosurgery



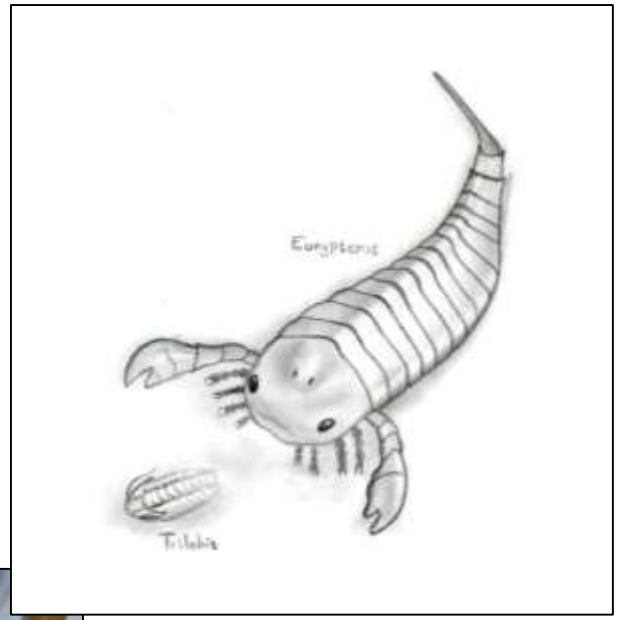


„Philosophy – why are the things how they are? Why do the nerve tracts decussate?“

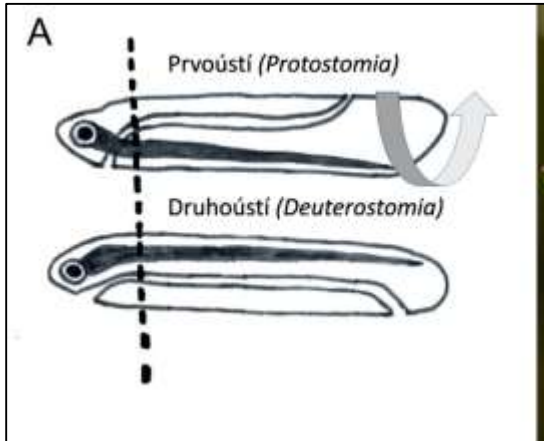
Santiago Ramón y Cajal
(lens crystallina)

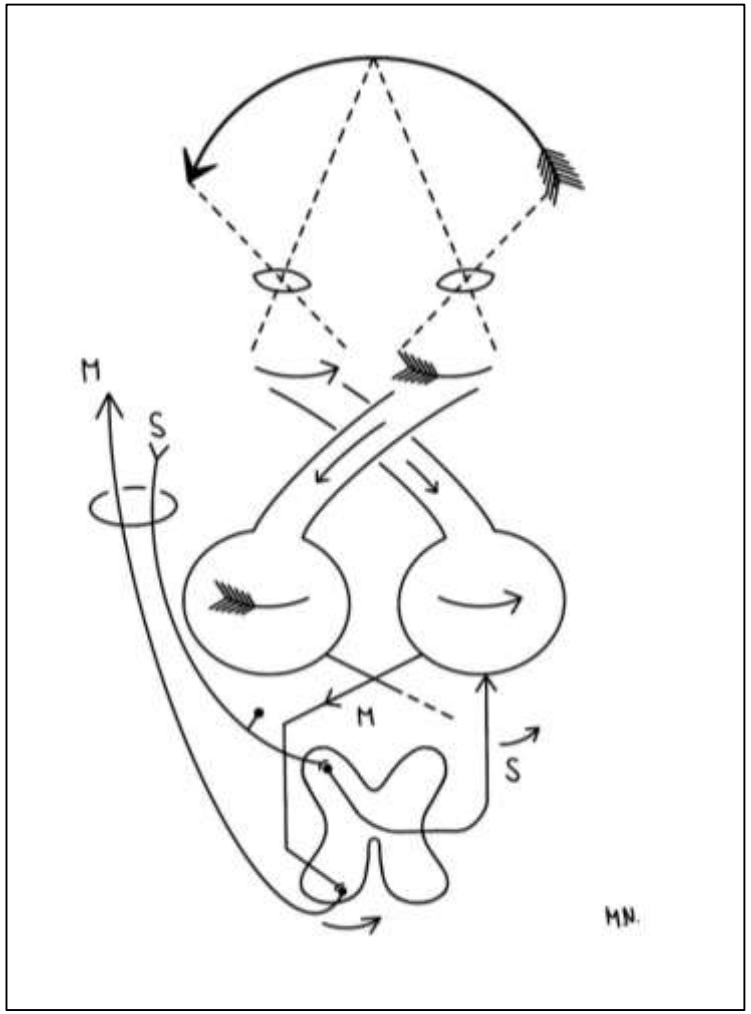


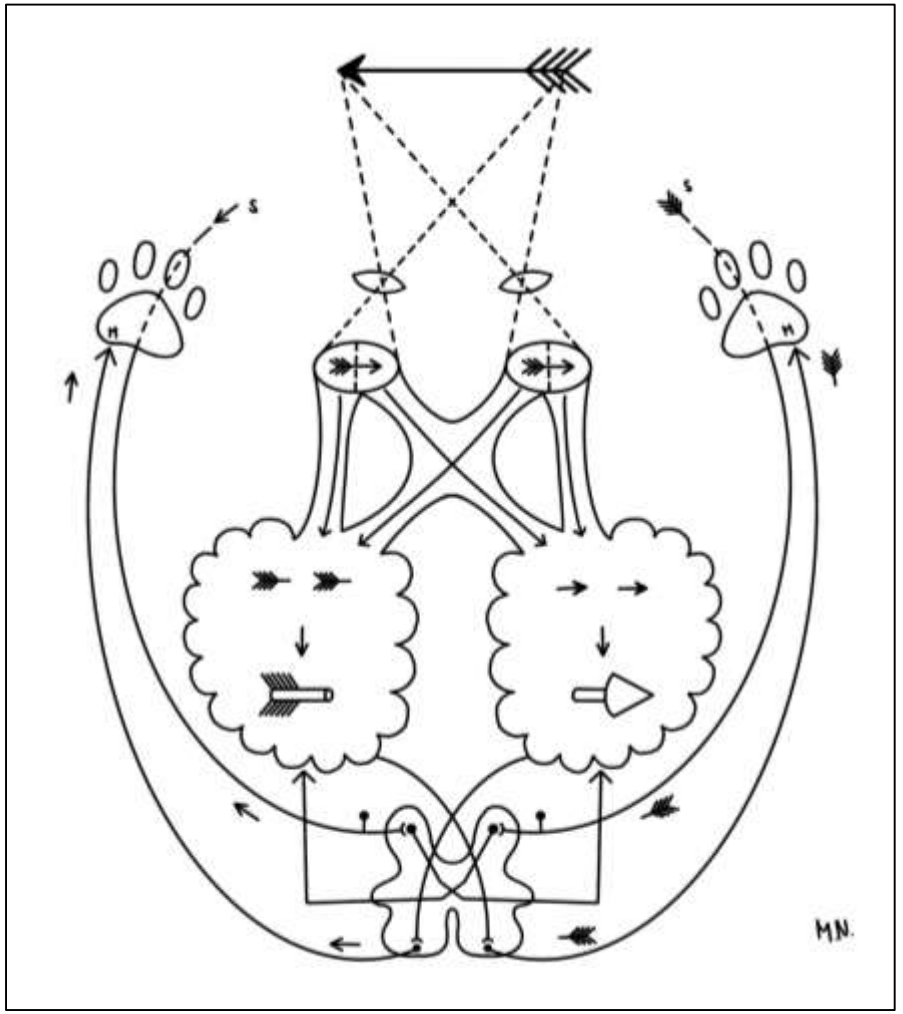
Predator theories



Somatic twist



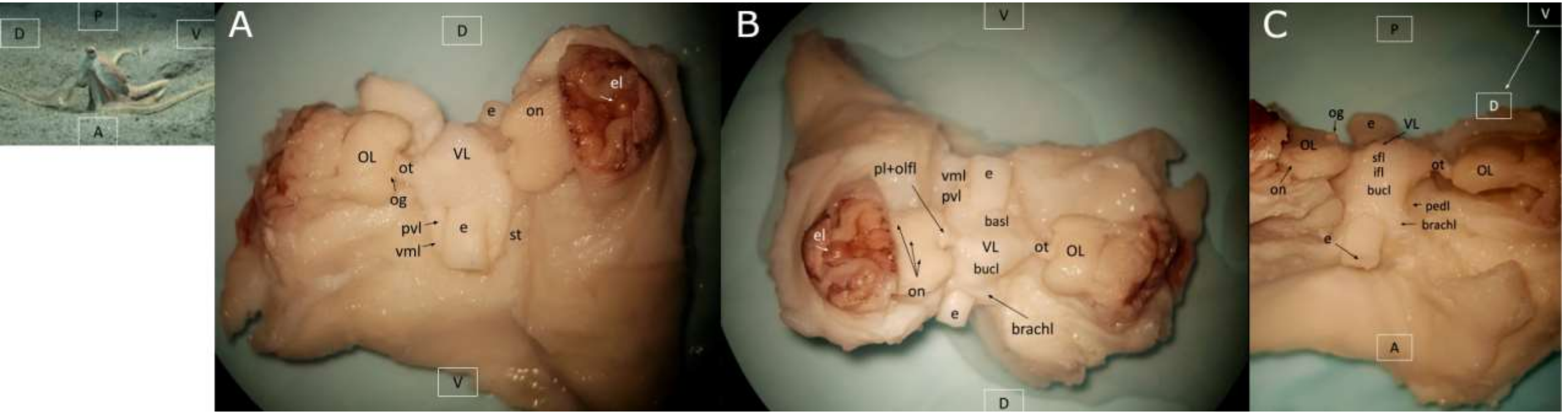


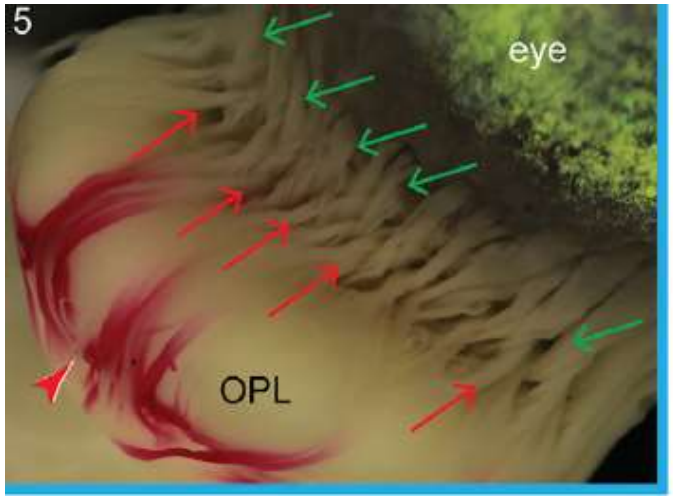


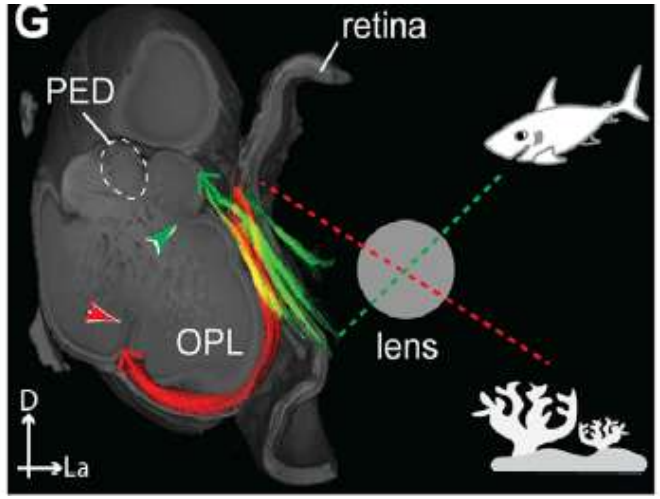
(Estructura del kiasma óptico y teoría general de los entrecruzamientos de las vías nerviosas. Rev Trim Micrografica 3:15–66, 1898)

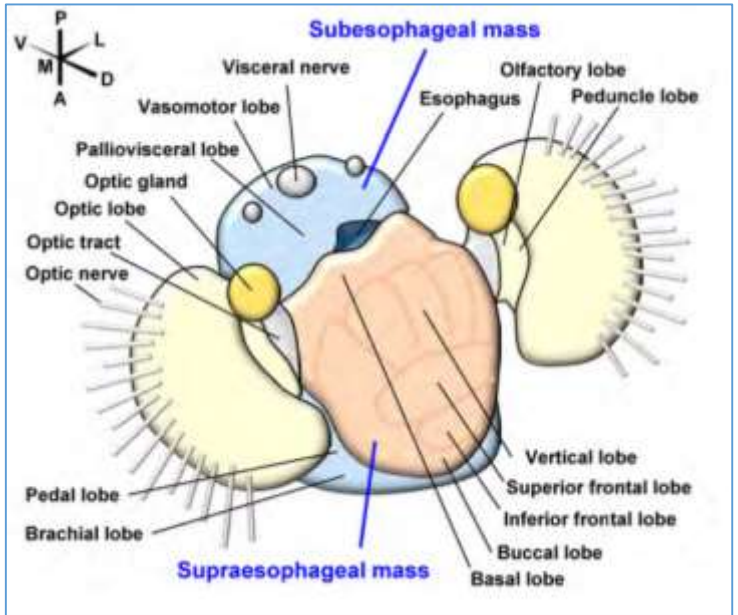
Explains the crossing of corticospinal, spinothalamic, lemniscal and visual tracts.

Octopus vulgaris

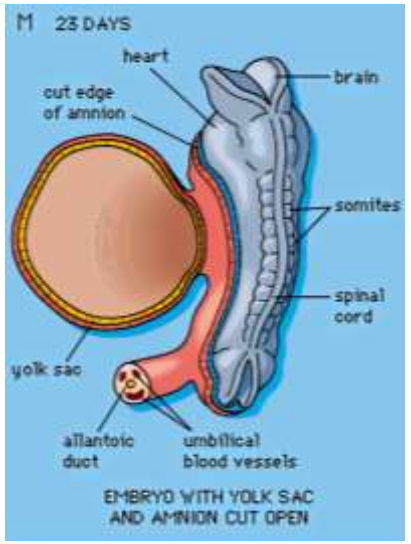








Somatic twist 2012 Marc de Lussanet and Jan Osse (2 phase a o 90° against each other = 180°)



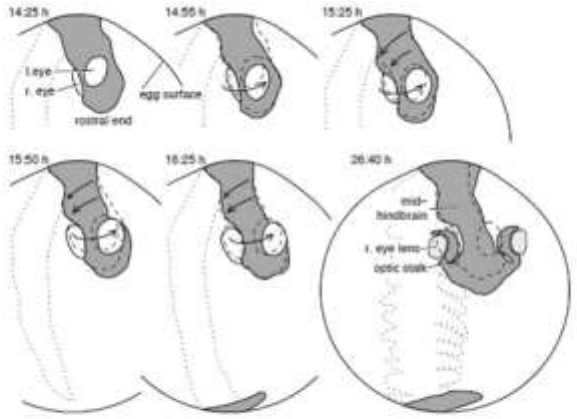
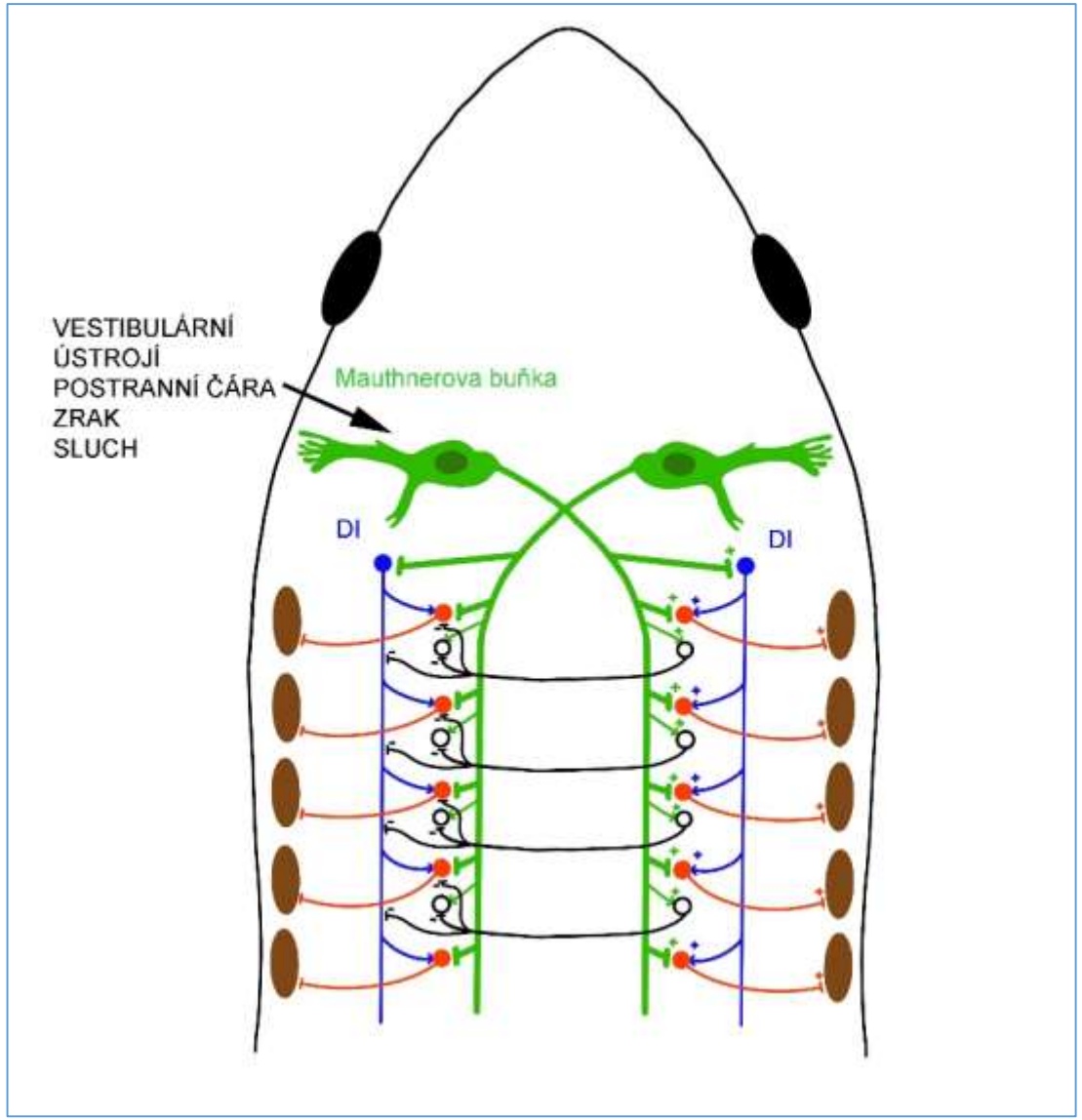


Figure 4: Antero-dorsal view on the head and anterior trunk region of a zebrafish embryo (*Danio rerio*) on the egg surface (see supplementary movies Appendix A.1, Appendix A.2). The embryo is drawn in grey, the prospective eye regions white. Dashed contours show the previous location of the embryo. The location of the body on the back side of the egg is drawn dotted. Compensatory movements can be observed between 14:40 and 16:40 p.f. During this period those cells that will form the eyes migrate anti-clockwise (perspective of the embryo), whereas the future mid- and hindbrain cells migrate clockwise between 15:15 and 16:40 h (arrows). The right eye is initially invisible because it is hidden below the cells that will form the forebrain. The first 5 frames are interleaved by 30 min, the last one is 10:15 h later. Drawn from Keller et al. (2008): supplementary movie no. 2.

N. trochlearis (IV) - m. obliquus superior – completly crossed, exits on the posterior surface of the mesencephalon
His antagonist m. obliquus inferior – non-crossed n. oculomotorius

Fritszch and Sonntag 1990 – sectioning the NIV in Xenopus laevis embryos – regeneration and inervation of the ***ipsilateral eye***
Theory: m. obliquus superior is the oldest eyemotor muscle and NIII a NVI ingrow ipsilateraly after twist occurence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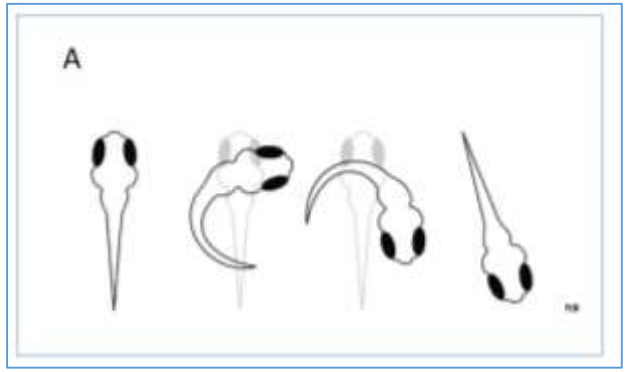
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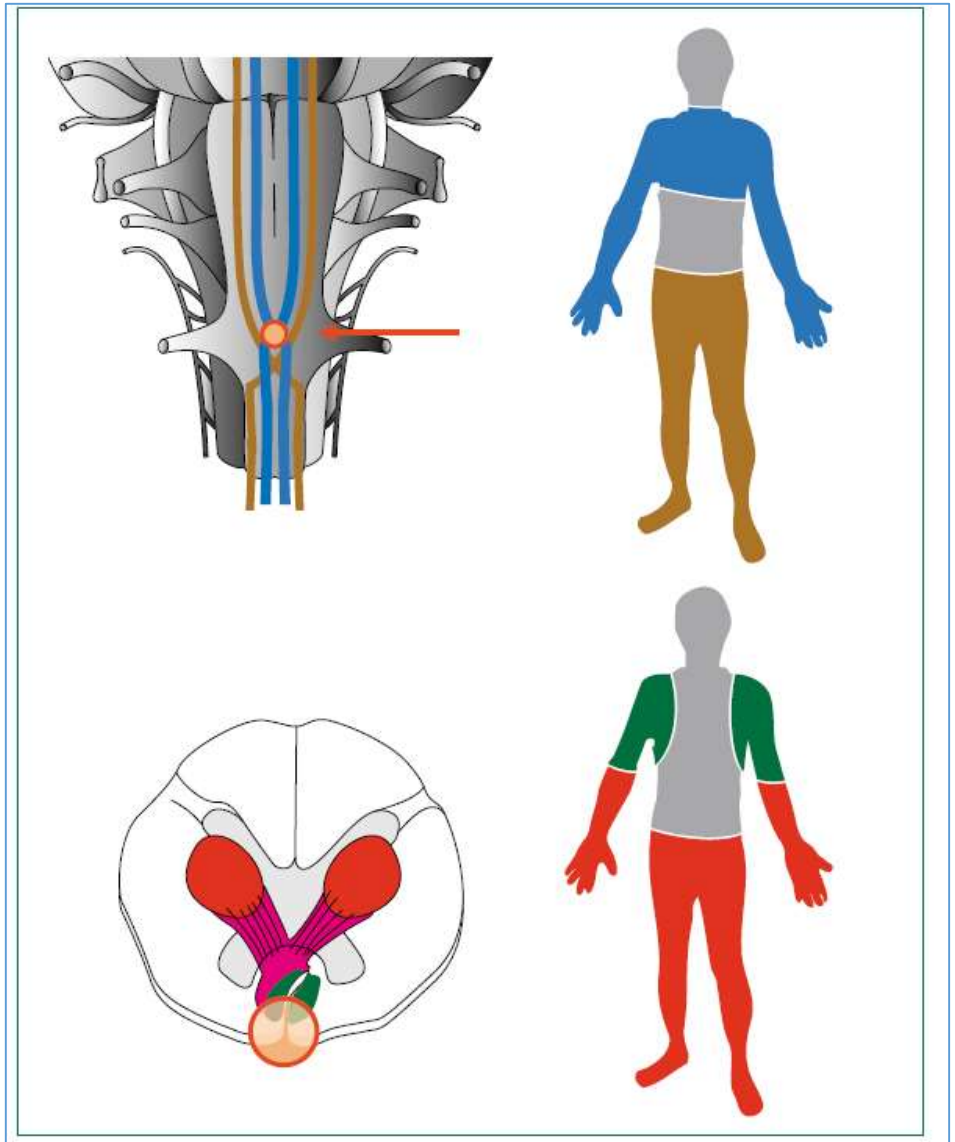
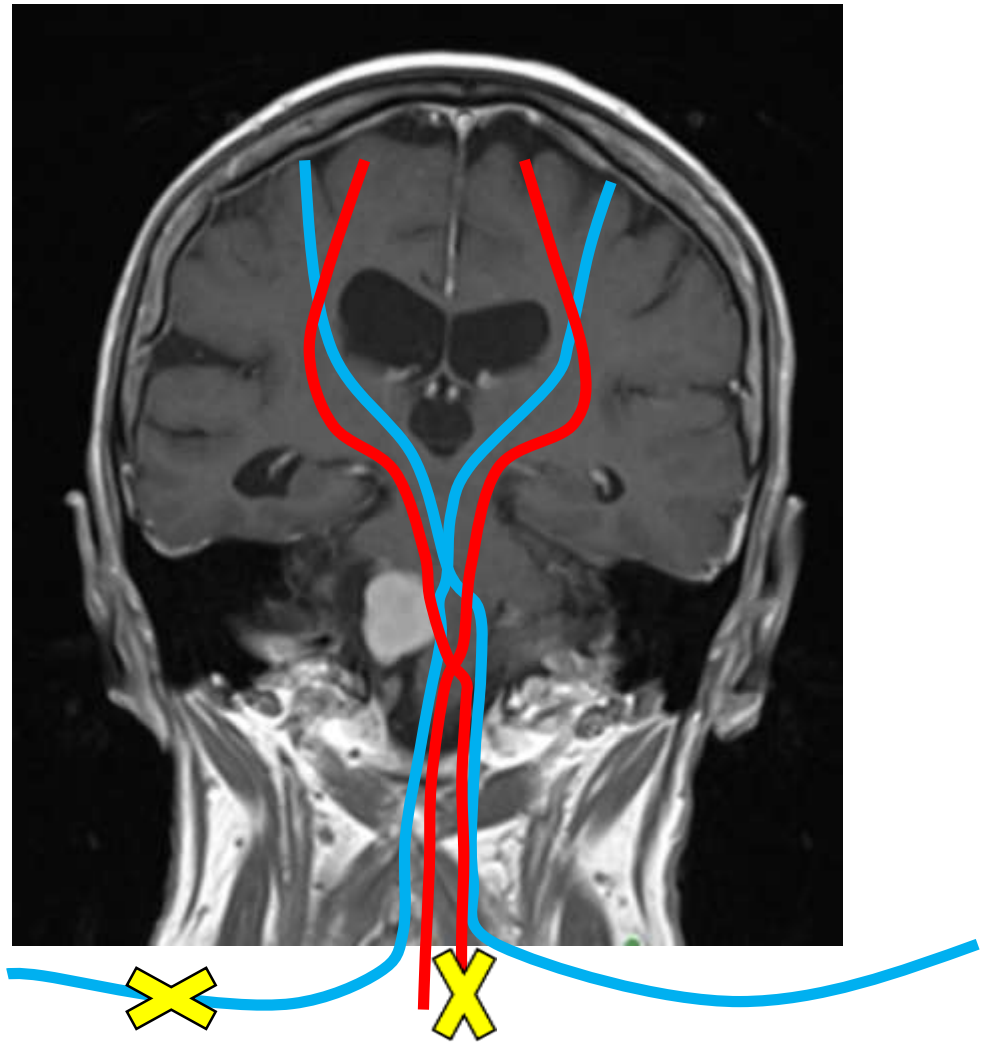
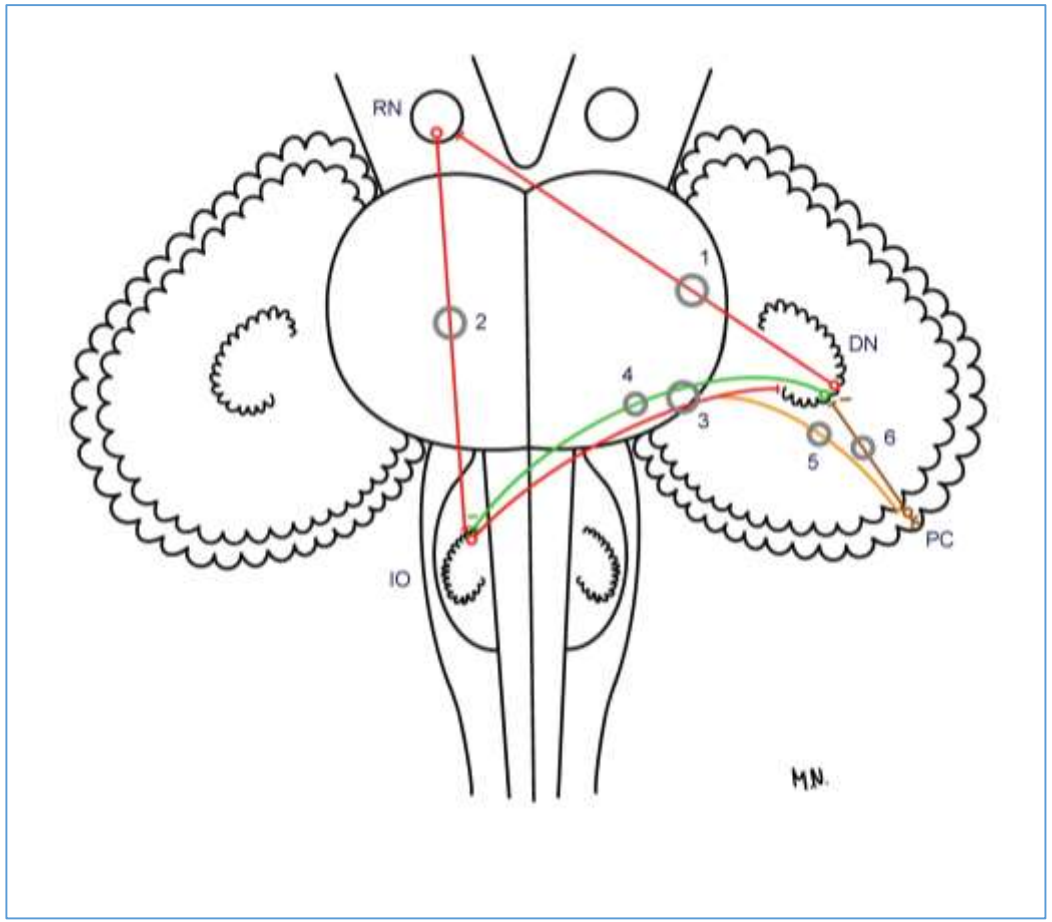


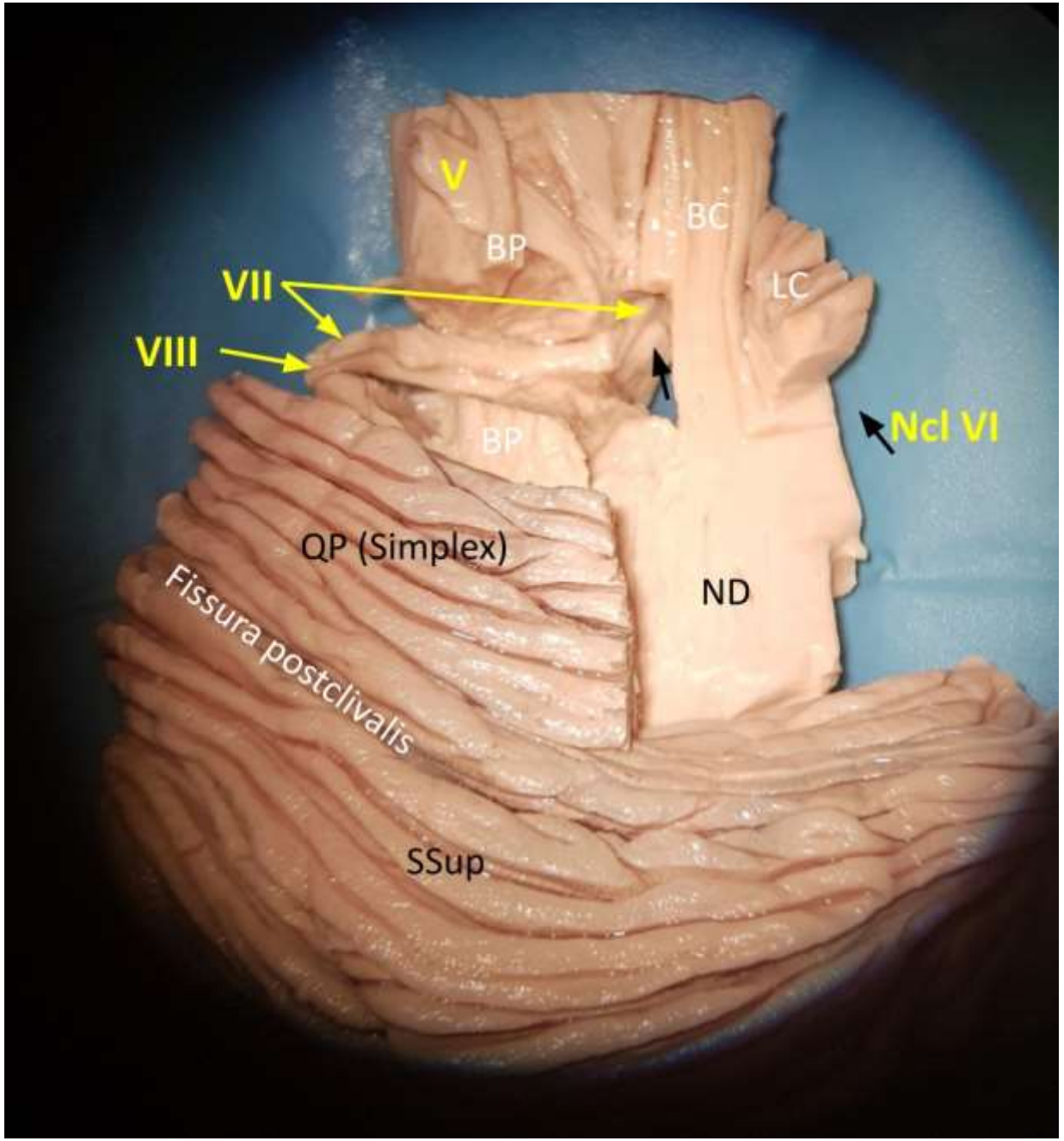
Figure 5: **Cruciate palsy**
Top: Wallenberg's view of the pyramidal decussation in the lower medulla oblongata. Corticospinal fibres involved with arm movements (blue) cross rostrally to those involved with leg movements (brown). A midline lesion at the rostral border of the decussation (orange circle indicated by the arrow) would therefore only affect arm mobility. However, no evidence for segregated crossing exists.[96-100] Bottom: axial view at the level of the pyramidal decussation. Alternative to Wallenberg's model: a midline lesion (orange circle) at the pyramidal decussation would affect mainly the ipsilateral CST (green), which innervates predominantly the proximal arms while sparing the crossed CST (red).

Wallenbergs syndrome – sy. of lateral medulla oblongata
Rare case of ipsilateral hand paresis and contralateral leg paresis

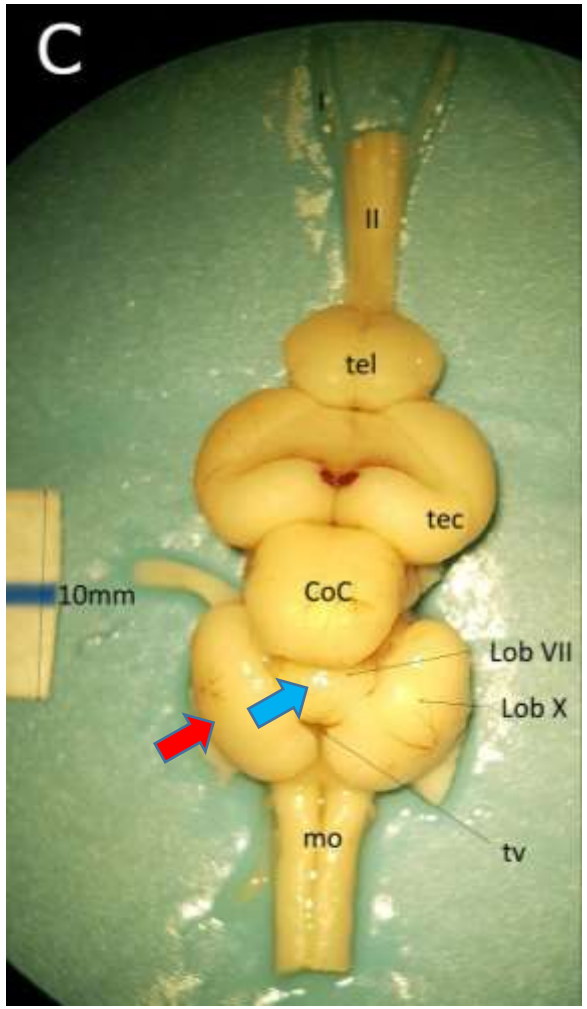


Control cerebellar circuit
Guillian – Mollarets triangle

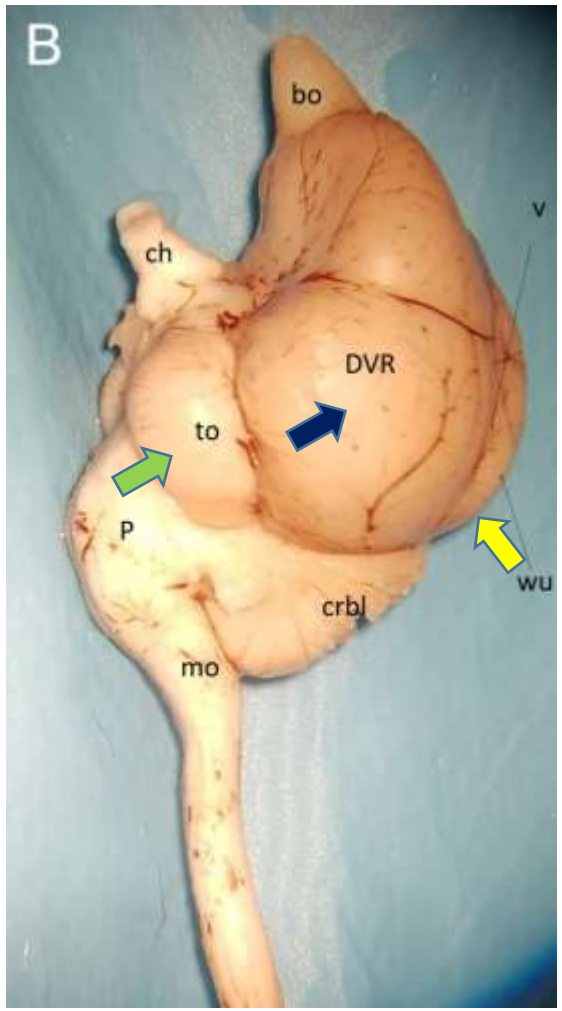




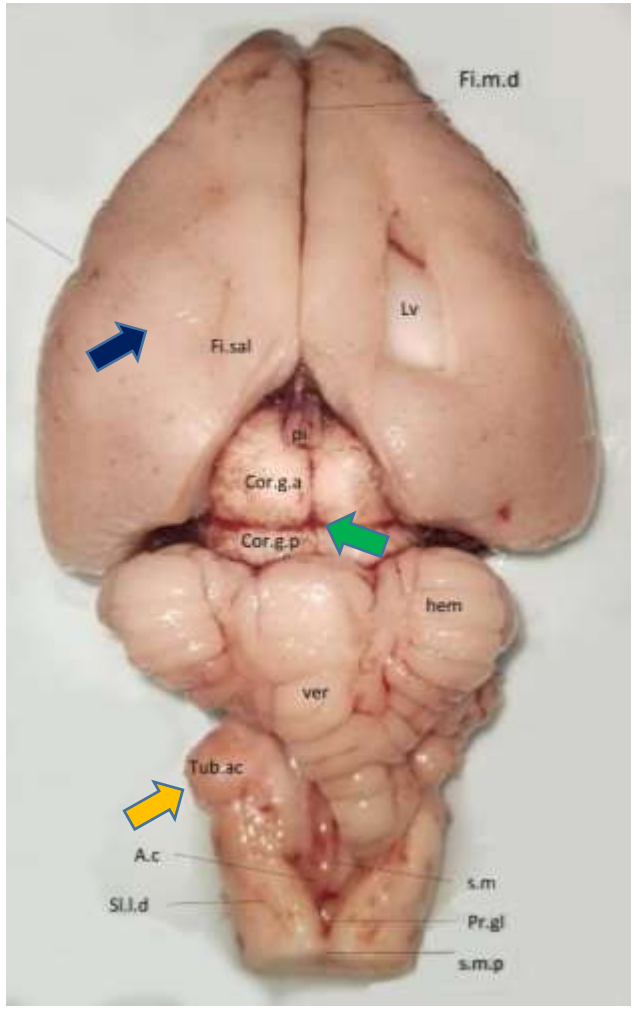
Carp



Duck



Rabbit



- **Děkuji Vám za pozornost.**

Thank you for your attention.