# 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

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

lateral lentikulostriatic perforators M1 a M1/2 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



Projection Association Comissural Circuits (Control)

Tracts



## Dissection of cerebral tracts by the Klingler technique







# 





## Surgical technique: Microsurgery





## Awake resection – some limitation

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

#### ALC: NUMBER OF TAXABLE PARTY.

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

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

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#### Úvod

Standardními polohami pacienta béhem resekcí mozkových nádorů s "awake" fází isou buď poloha na boku nebo supinační poloha s podložením ramene a malou rotaci hlavy. Poloha v polosedě (semisitting) umožňuje lepší vízualizaci 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 úspéšnou primární parciální resekci multiformního glioblastomu (GBM) uloženého v levé parieto-okcipitální oblasti v červenci roku 2015. Operace byla vedena v celkové anestezii. Tésně před započetím zevní frakcionované radioterapie



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).

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 isme hodnotili jako téměř úplnou. Drobné reziduum tumoru bylo ihned ozářeno Leksellovým gamma nožem, následovala chemoterapie, současné 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 traktografii. 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 peroperačniho neurologického deficitu isme také souhlasili s kontinuální monitoraci 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-

zhruba měsíc po operaci pacient prodělal



Obr. 2. Průběh operace.

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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)











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 Supracerebellartranstentorial and Miniinvasive Suboccipital Approach to the Entire Length of the Mediobasal Temporal Region Glioma

#### Souhm

SHORT COMMUNICATION

V todalom atlikev prozentujene kazastiku Skiteliho pacenta u gliomem ole atlijev nedobaziliri temporabil oblast sposo. Pro jeko mokol jene pošli pazaredarivi supracemislažni turnomnovala pitnas, který pres museli dopim mirenárim turokrvim abolopišnimi pitnajem. Poznojeme anatomický azpekt, chrvenjaža detaly a živný mirení elegintního pitnagu k medobaziliri temporábil sblasti, častlenu sli orkoceurochruegokých a spijestochruegošký výková.

#### Abstract

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In a short communication, we describe a case of a 64 years old patient suffaring from glottan of the entre-length of the mediatawal temporal areas of the right hemisphere. For its resotion, we have welected gueranedian supercendence-transmission patients that had to be supplemented with the minimised evenue subscriptulal approach. We thecase an anexemptial aspect, surgical details and limits of this elegant approach to the mediatawal temporal area, the frequent target of cases and apples surgeties.

Supported by European Regional Development Fund - Project H&EA-KRC Bloc. EZ 1 05/

Poshkowani: prof. H. Bartalariffemu za motivaci k provedeni operace a vysaktieri technických

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Muito k recenzi 23, 12, 2013 Muito do taku: 22, 1, 2014

#### Kličová slova

muduový gliom – epilepsie – hypakampus – temposáhi lakik

#### Key words

brain g6oma - epilepsy - hippocampus temporal lobe









# 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









### M.G. Yaşargil

### U. Türe







Knowledge Skill Carefulness Patience Humility Compassion



### Max Nûnez





# "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)



#### X0X20479043

#### 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

#### Soutes

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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





MDPI

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

Bartos Robert 1.2, Lodin Jan <sup>1</sup>, Hejčl Aleš <sup>1,1,4,4</sup>, Sames Martin <sup>1</sup> and Cihlar Filip <sup>3</sup>







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Case Report	A Hot Science
Rescue version of a carotid micro-endarterectomy: an ACE anastomosis with proximal ica and distal ACE hemoclip of	-ICA

Robert Bartolsh, Alel Hegily, Jan Lodin', Martin Samely and Tomas Manik'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

Rabret Bates<sup>1,3</sup>, Jan Ledin <sup>1,0</sup>, Ales Hejël <sup>1,5,4,4</sup>, Ivan Hamhej <sup>1</sup>, Ingrid Concepción <sup>1,5</sup>, Filip Cihlář <sup>4,0</sup> and Martin Somet <sup>1</sup>





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#### CASE REPORT

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<sup>a,b</sup>, Jan Lodin<sup>a</sup>, Tomas Marek<sup>c</sup>, Martin Sameš<sup>a</sup>, Veronika Němcová<sup>b</sup> and Roman Liščák<sup>d</sup>

\*Department of Neurosurgery, Masaryk Hospital, Ústí nad Labern, Czech Republic; \*Department of Anatomy, First Faculty of Medicine, Charles University, Prague, Czech Republic; \*Department of Neurosurgery, Mayo Clinic; Rochester, MN, USA; \*Department of Stereotatic and Radiation Neurosurgery, Na Homolec Hospital; Prague, Czech Republic;

#### ABSTRACT

Background: Hemangicblastomas 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 coupling, tongue paresis and headache and vomiting. Magnetic resonance imaging (MR) revealed a large cystic lesion with a small intramual nodule located in the left anterolateral medulla oblongata directly behind the ventebral artery. The diagnosis of hemangioblastoma was supported by digital subtraction angiography. Conclusion: Combined therapy consisted primarily of acute surgical fenestration and permanent

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 natiosurgery 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 Iterature for this pathology. ARTICLE HISTORY Received 22 June 2020 Revised 22 August 2020 Accepted 28 August 2020

Taylor & Francis

(R) Check for updates

KEYWORDS Hemangloblastoma; medulla oblongata; surgical treatment; radiosurgery







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

**Predator theories** 

Santiago Ramón y Cajal (lens crystallina)



### 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: Antara-dormal view on the head and anterior trunk region of a subrafield embryo (Damis verto) on the egg surface (see supplementary movies Appendix A.1, Appendix A.2). The embryo is drawn in gray, the propositive operations white. Dashed resonant show the provines location of the embryos. The location of the body on the back wide of the egg is drawn distort. Compensatory movements can be observed between 14:40 and 16:40 p.f. During this period these cells that will form the eyes migrate anti-clockwise (perspective of the embryo), whereas the former 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 interlayed by 30 min, the last ene 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









#### 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.<sup>96-100</sup> 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









# • Děkuji Vám za pozornost.

# Thank you for your attention.