Curiculum Vitae

Rahadian Indarto Susilo, dr SpBS

- Fak Kedokteran Universitas Airlnggga 1996-2002
- PPDS Bedah Saraf Universitas Airlangga Surabaya 2003-2009
- Skull Base Fellow Program Keio University Tokyo Japan, 2009
- WFNS Grade A: Skull Base Fellowship Program Osaka City University, Japan. 2011
- Neurooncology Division, Neurosurgery Department Airlangga University- Dr. Sutomo General Hospital, Surabaya, 2009 - now

BRAIN TUMOR UPDATE 2018

Tumor Otak

TEHNOLOGI & PENANGANAN TERKINI

Rahadian Indarto Susilo,

Irwan Barlian Imadoel Haq, Joni Wahyuhadi

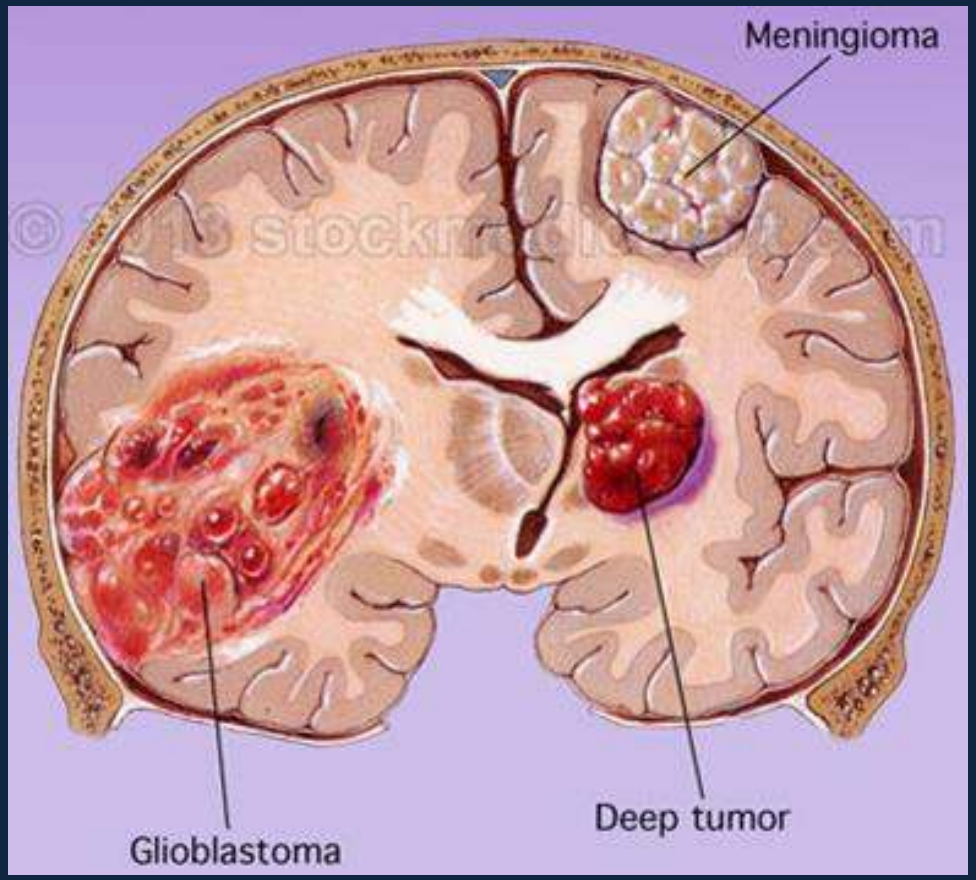
Divion Of Neuro-0ncology & Skull Base Neurosurgery

Dept. of Neurosurgery, Airlangga Univ. Faculty Of Medicine / Dr. Sutomo General Hospital

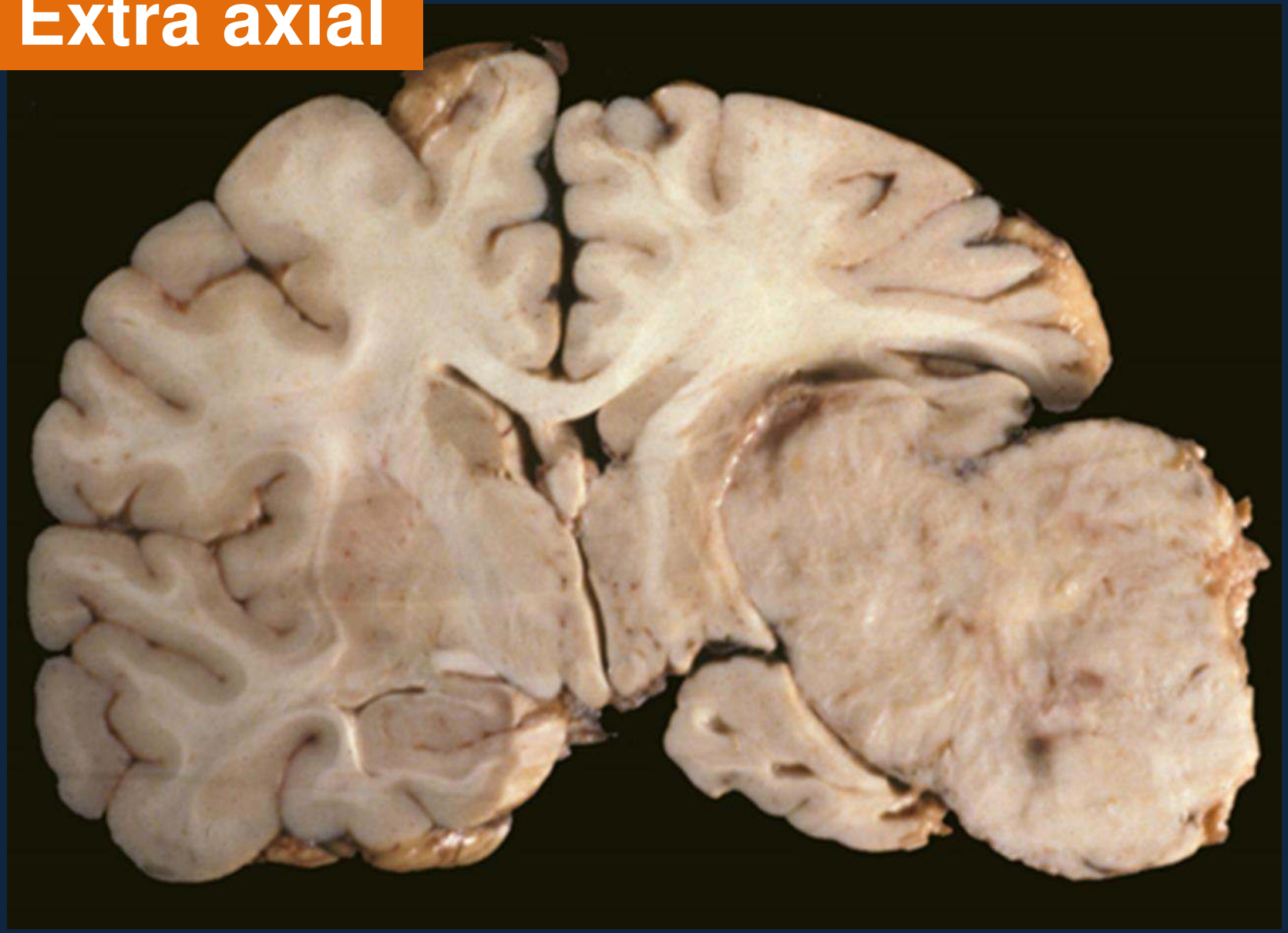
SURABAYA INDONESIA

Tumor otak

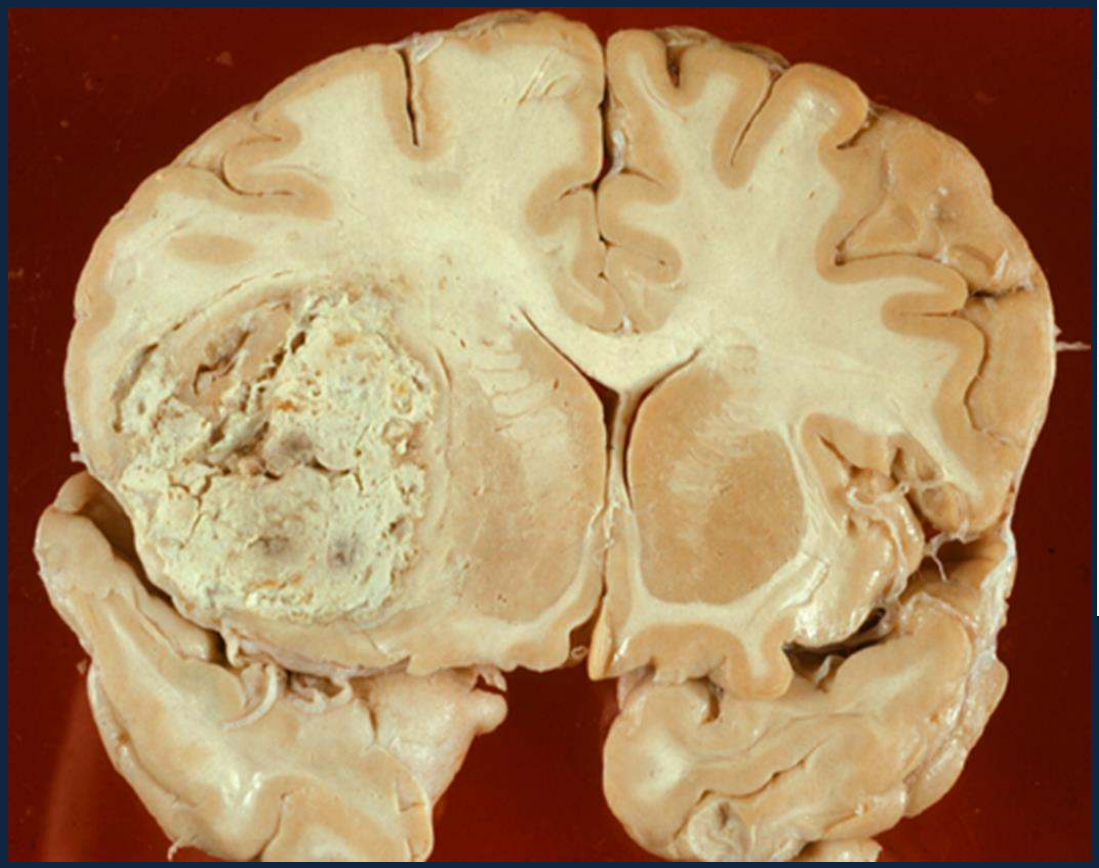
Pertumbuhan jaringan abnormal yang tidak terkendali di dalam otak

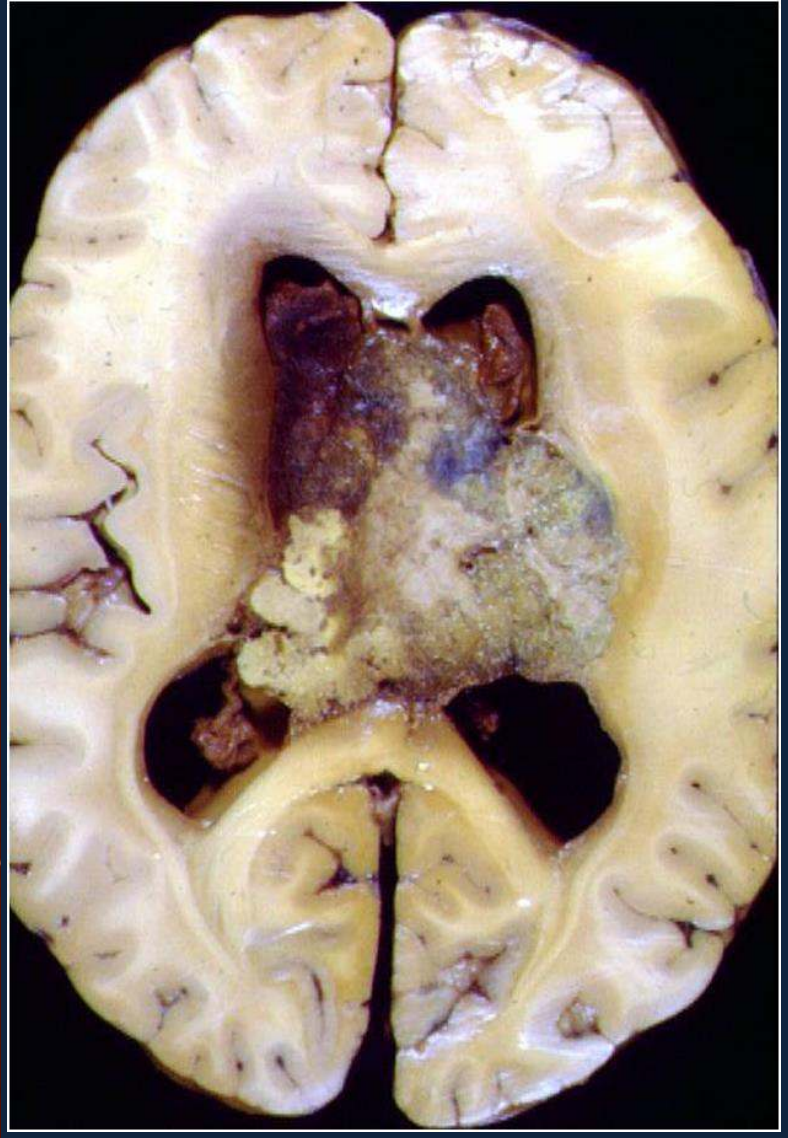


Extra axial

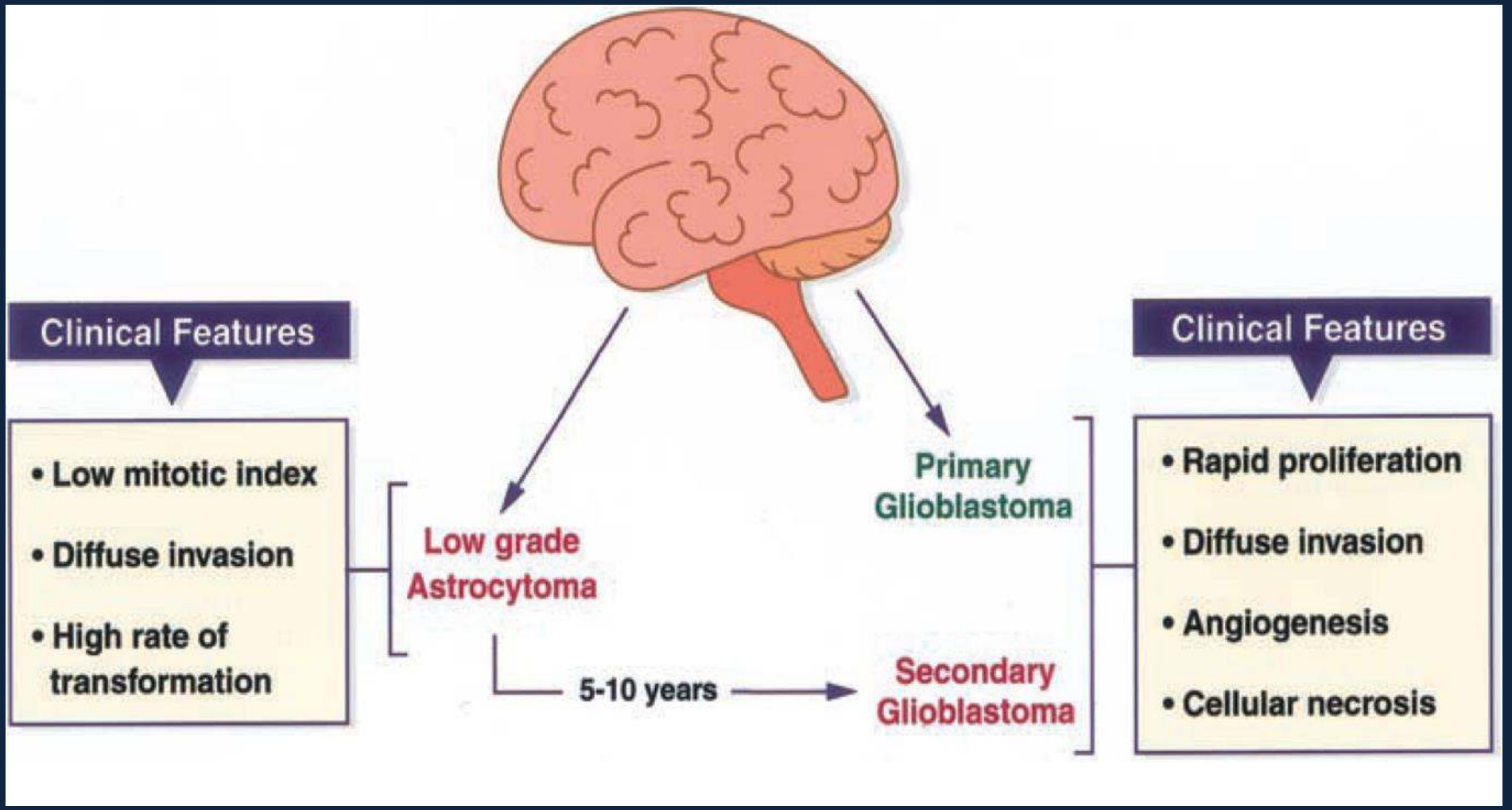


INTRA AXIAL





Clinical features

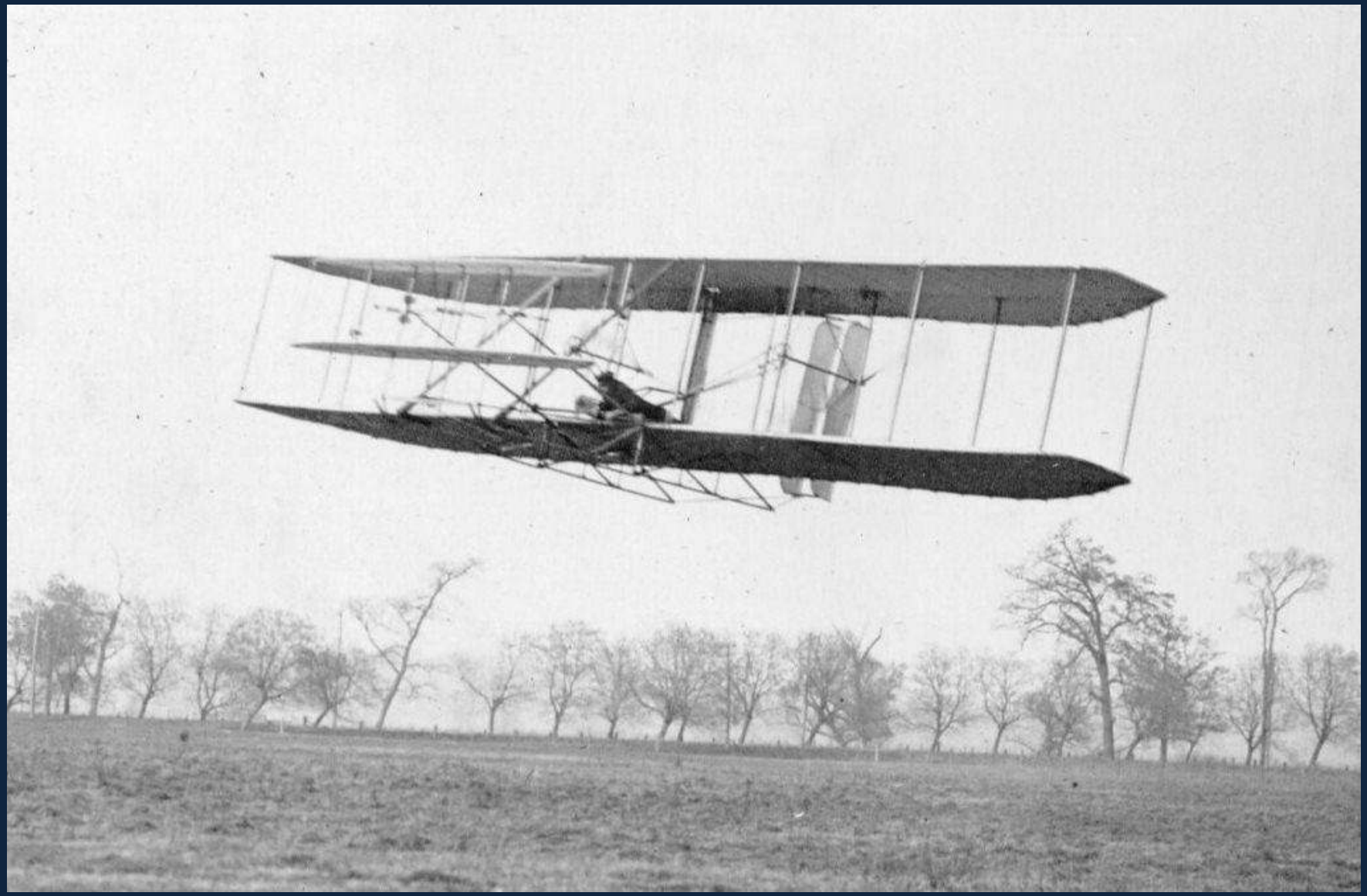


Terapi Tumor Otak

OPERASI

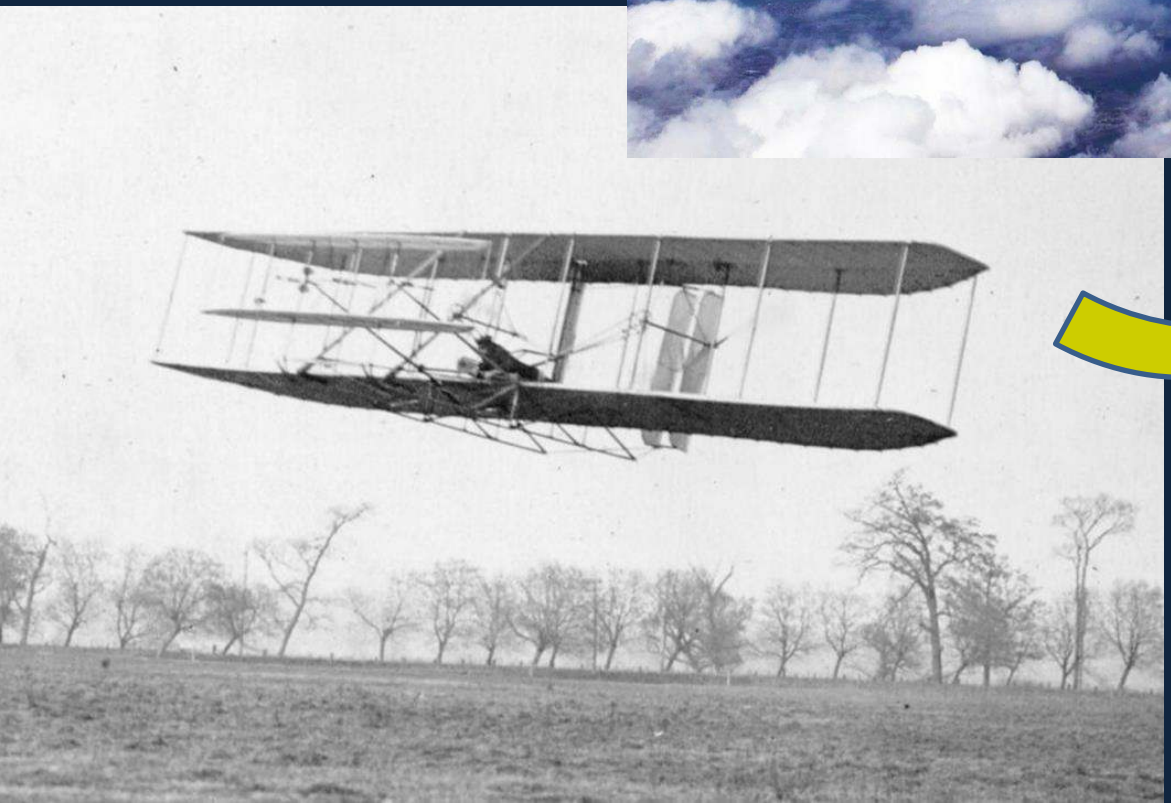
Apakah AMAN ???


GRAF ZEPPELIN



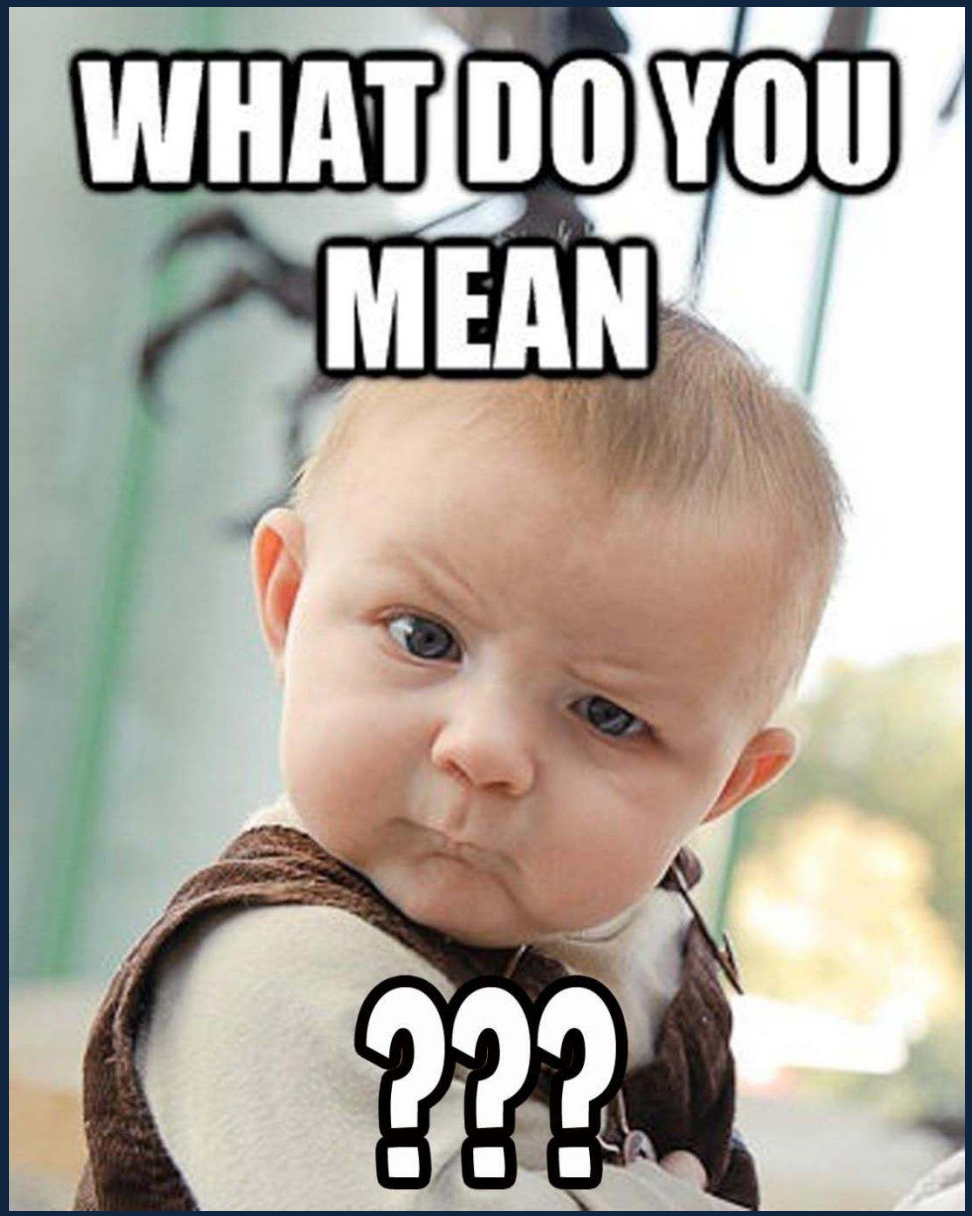

BOEING


BOEING



Terapi Tumor Otak

OPERASI


WHAT DO YOU
MEAN
???


Luck is what happens when preparation meets opportunity.
– Seneca

PREPARATION

Good Preparation → GREAT Preparation

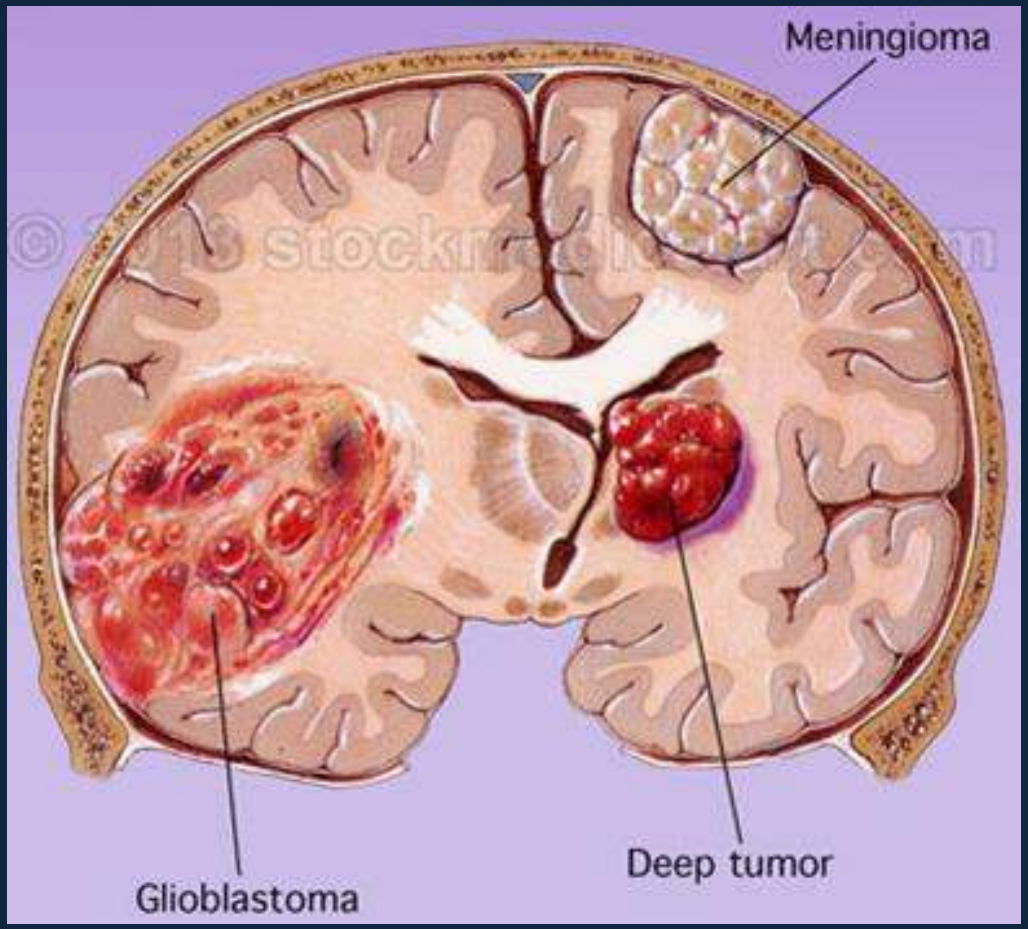
GOOD is the enemy of

PREPARATION

Good Preparation → GREAT Preparation

GREAT NEURO-IMAGING

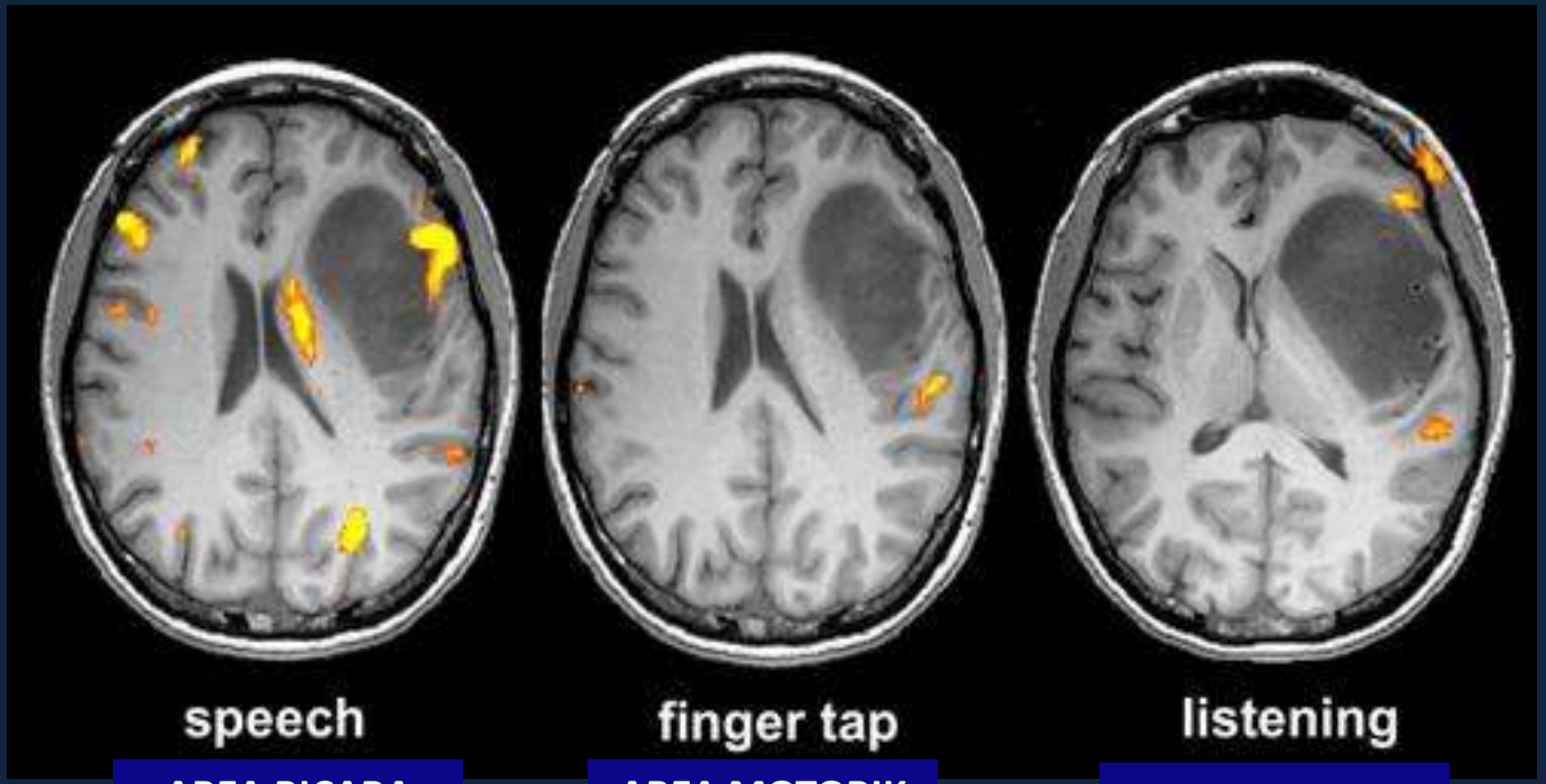
Bagaimana **membedakan** ????



jaringan tumor V/S **jaringan otak normal**

Functional MRI

pada TUMOR OTAK



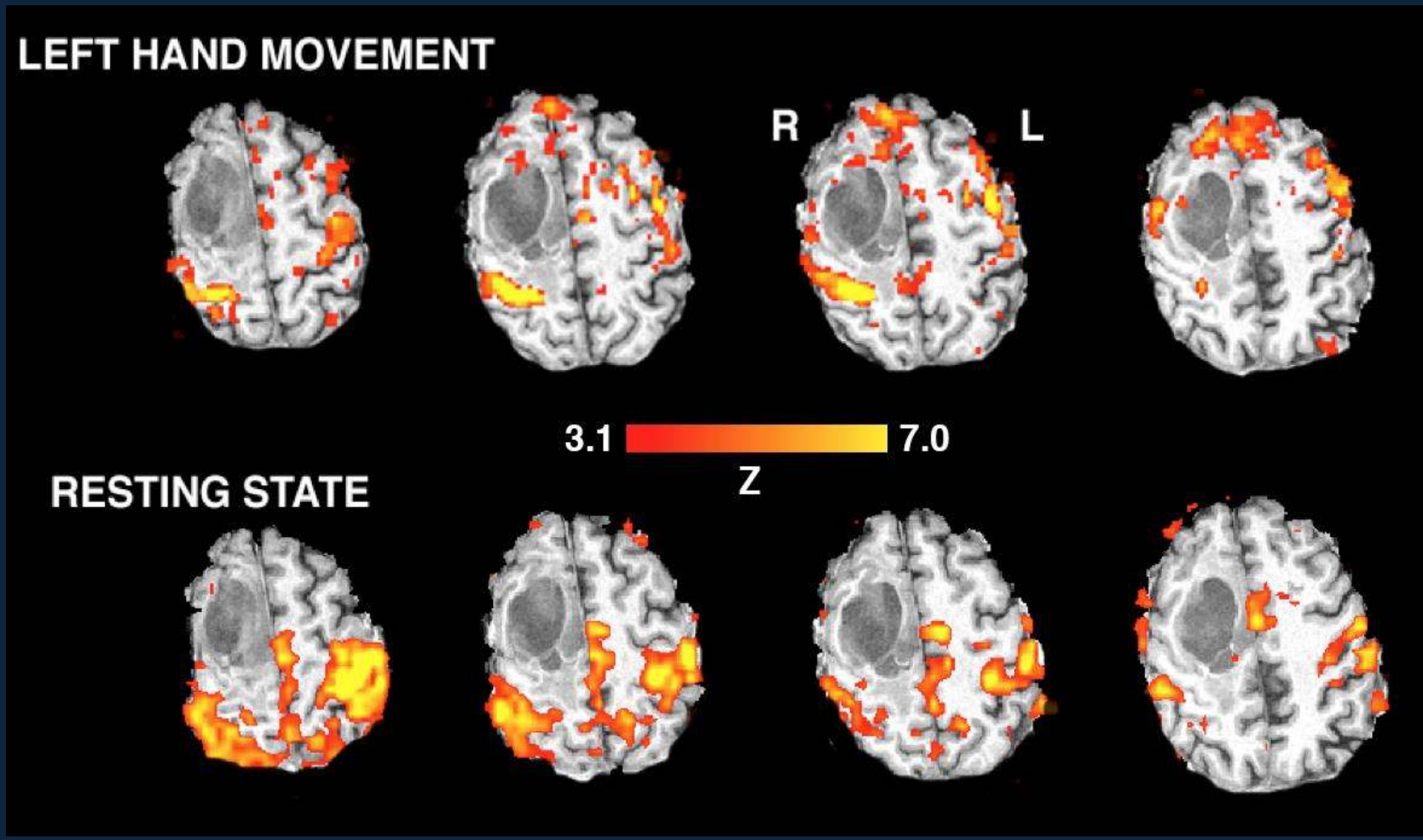
AREA BICARA

AREA MOTORIK

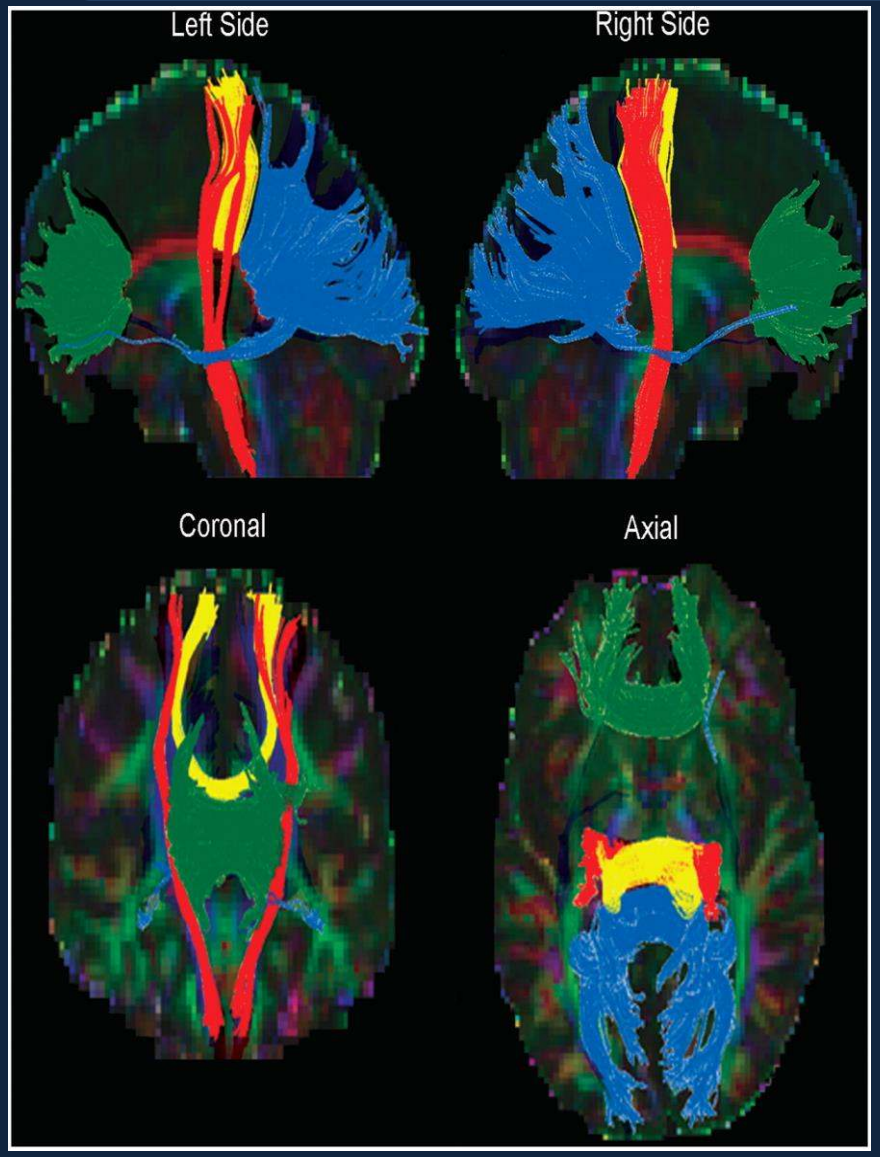
AREA BICARA

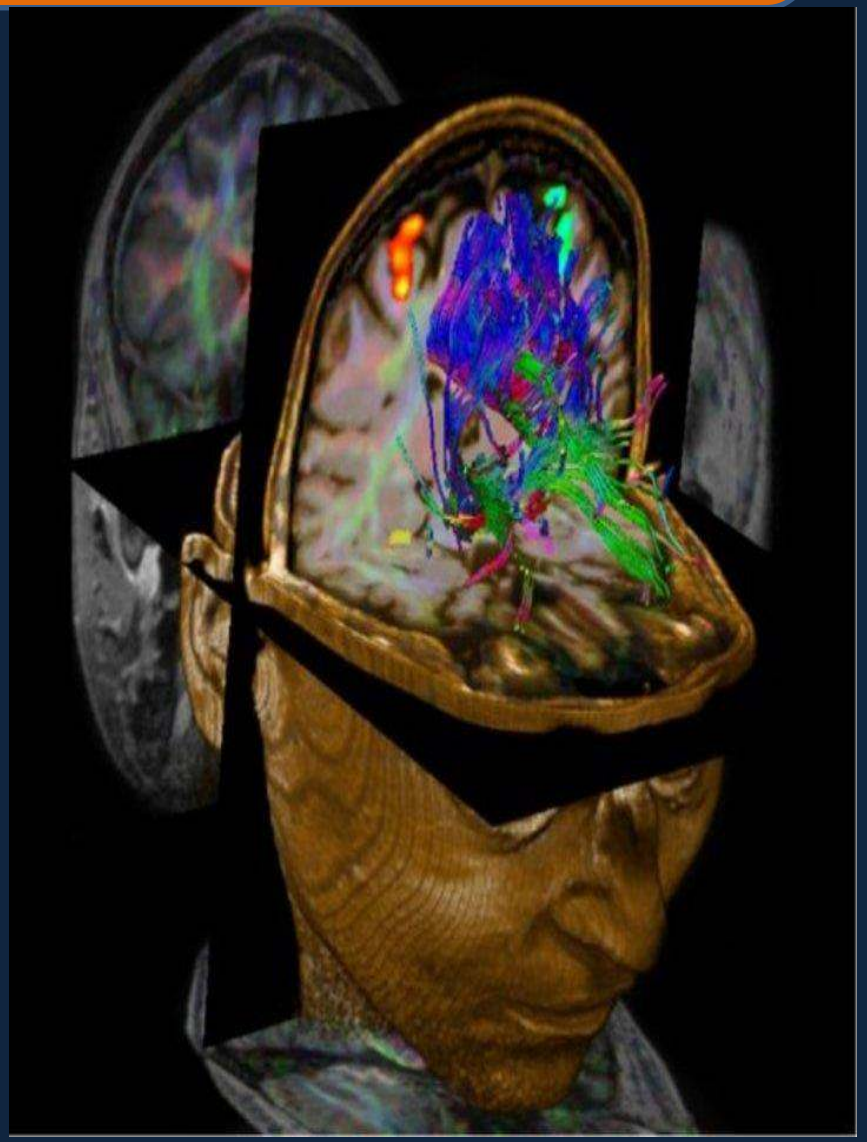
Functional MRI pada TUMOR OTAK

IDENTIFIKASI AREA MOTORIK

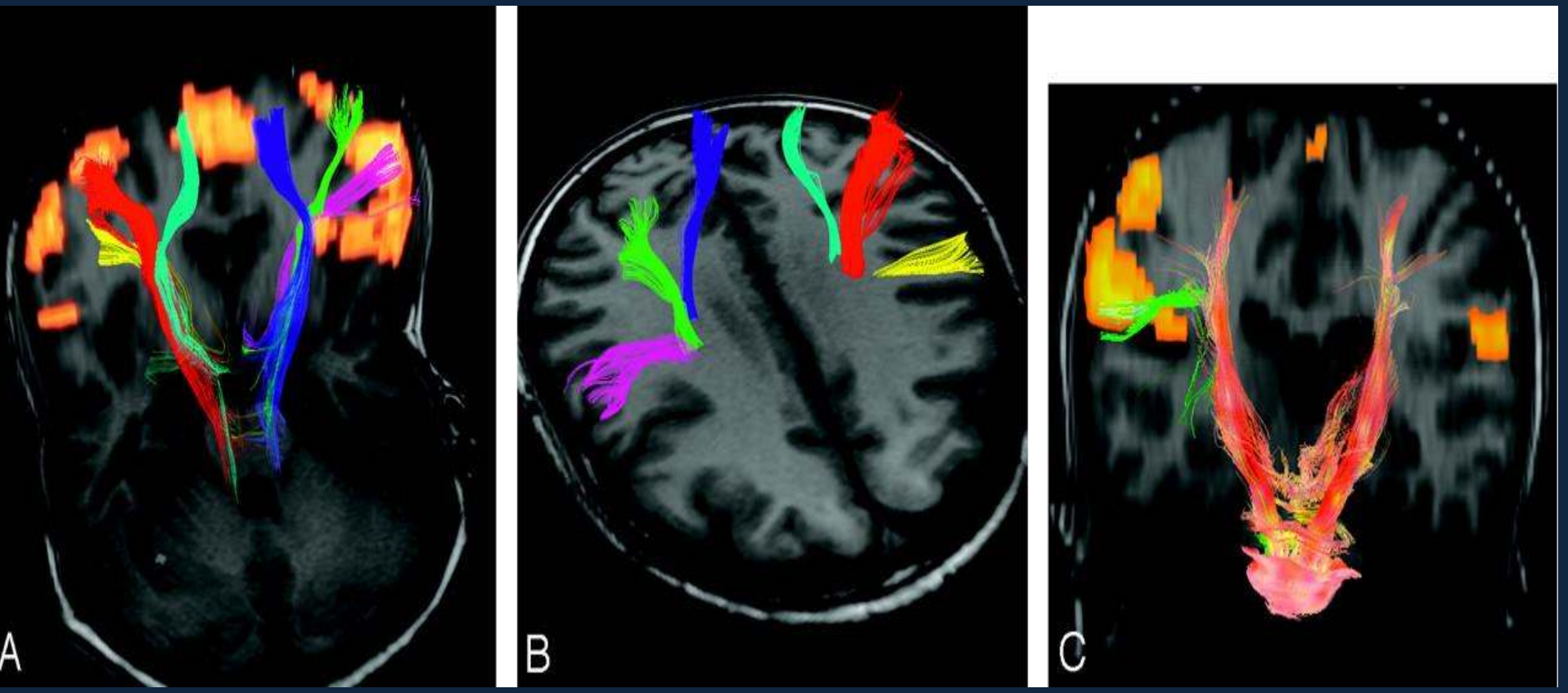


MRI Tractography
IDENTIFIKASI JARAS DI DALAM OTAK

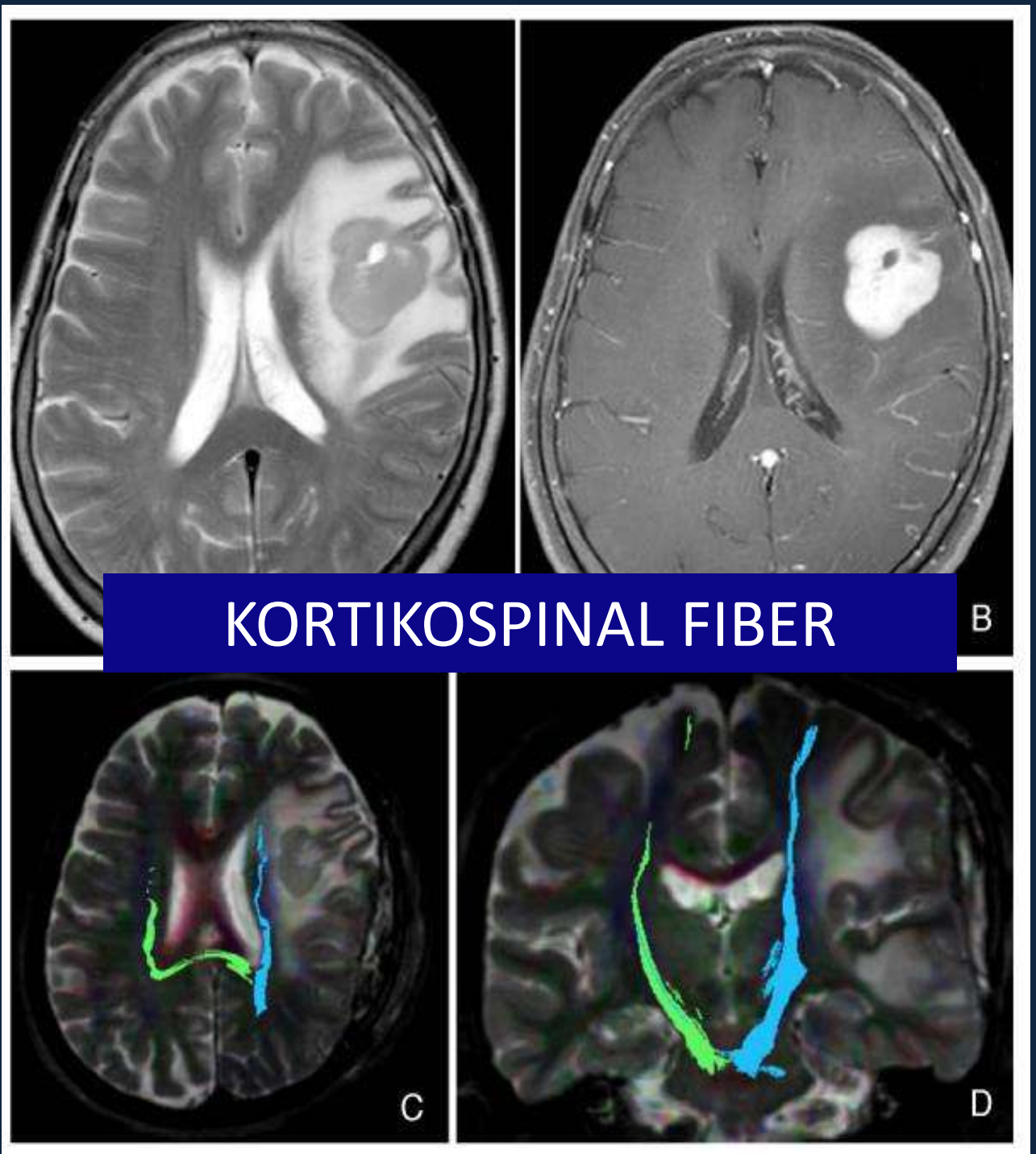




MRI Tractography

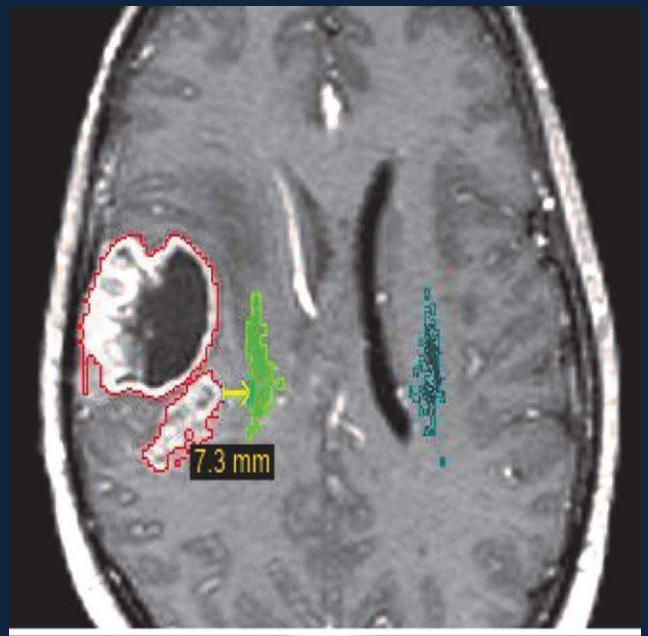


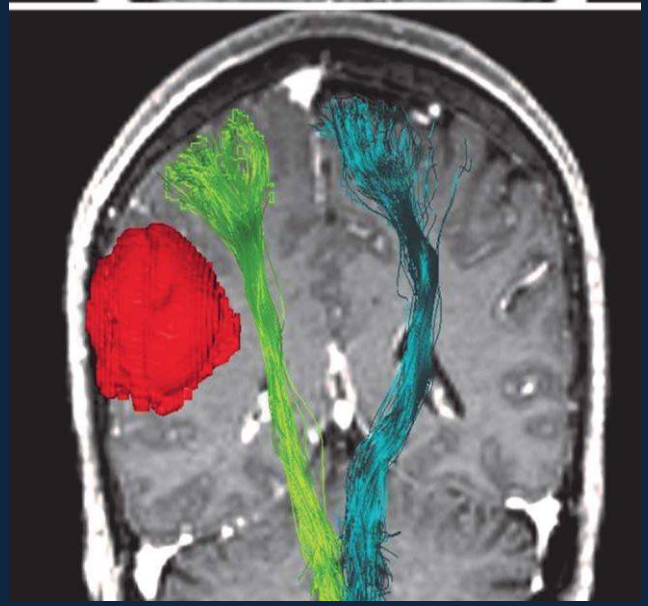
JARAS KORTIKOSPINAL

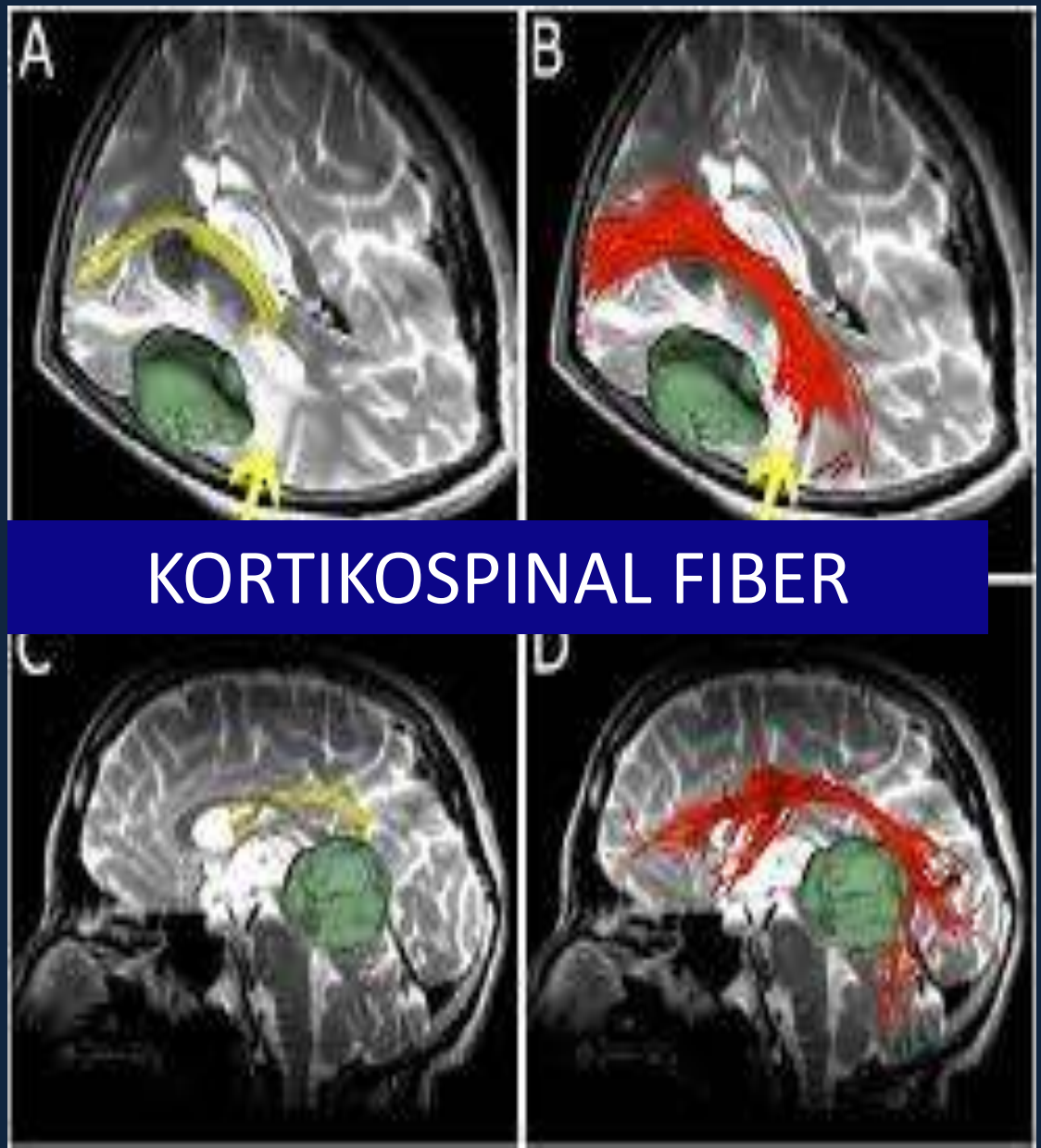


TRACTOGRAPHY pada TUMOR OTAK

MRI Tractography pada TUMOR OTAK







KORTIKOSPINAL FIBER

OPERASI BEDAH SARAF

Prioritas Utama

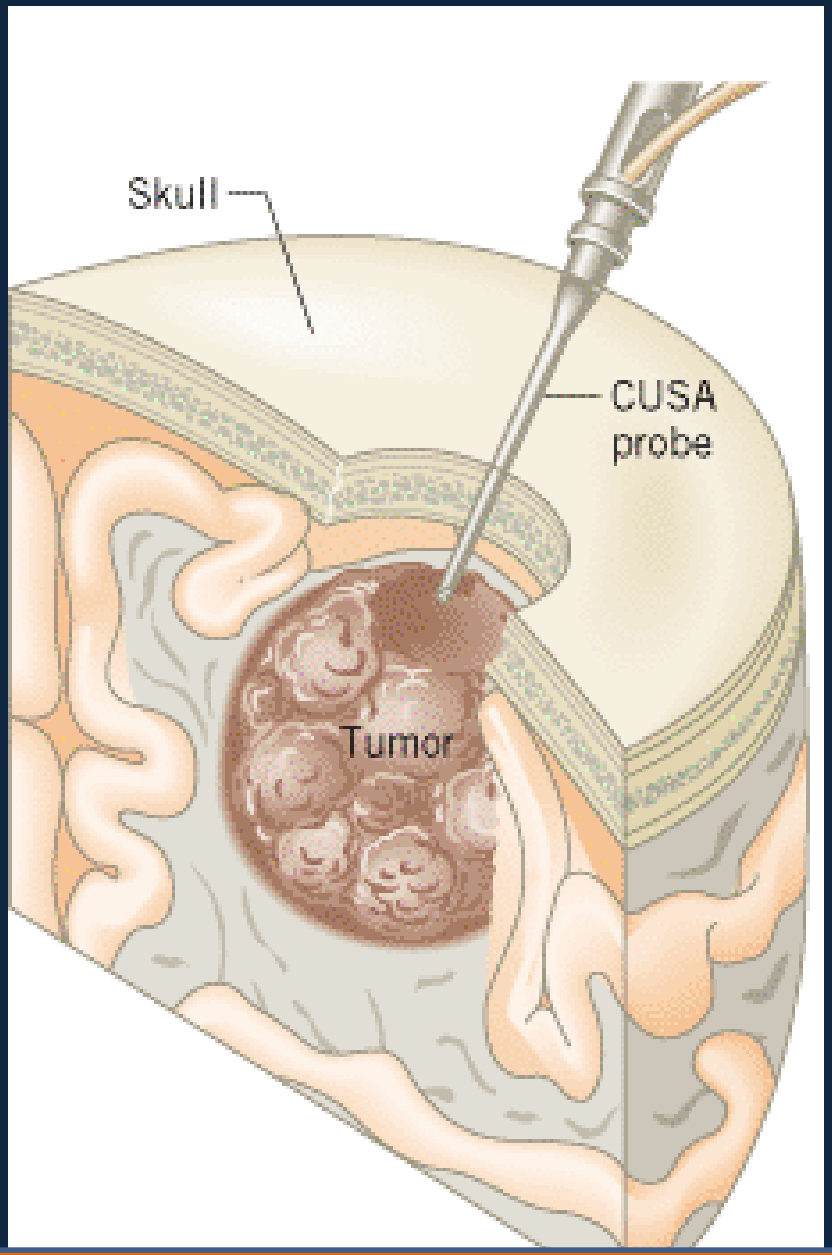
KUALITAS HIDUP PASIEN

Prioritas UTAMA

Keamanan Proses Pembedahan

Microneurosurgery

membedakan jaringan otak dan tumor



Alat Khusus Penghancur Tumor

cavitron ultrasonic surgical aspirator (CUSA)


ANISA, NY
24 Jun 2010
512
kV 120
mA 351
Head
Tilt: 0.0
W:100 L:40
LightSpeed VCT SYSNct99
S 144 Graha Arerta RSU Dr Soetoro SBY


ANISA
2010 06 30 08 17 51
Coronal
F

Keamanan Proses Pembedahan

Intra-operative monitoring

- Evaluasi fungsi saraf
- Area fungsi bicara
- Saraf wajah
- Saraf perasa
- Saraf penggerak

Keamanan Proses Pembedahan

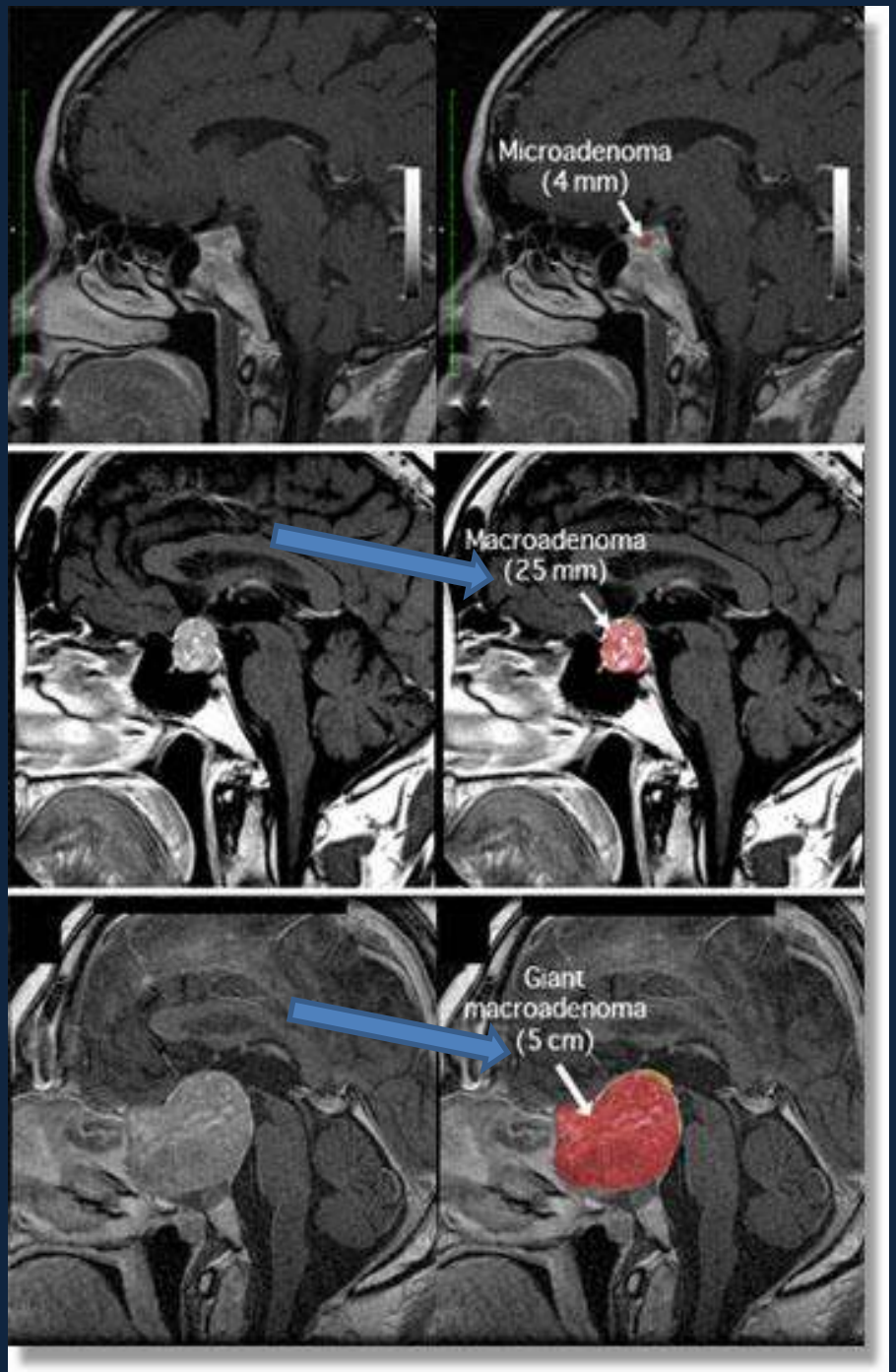
Intra-operative monitoring

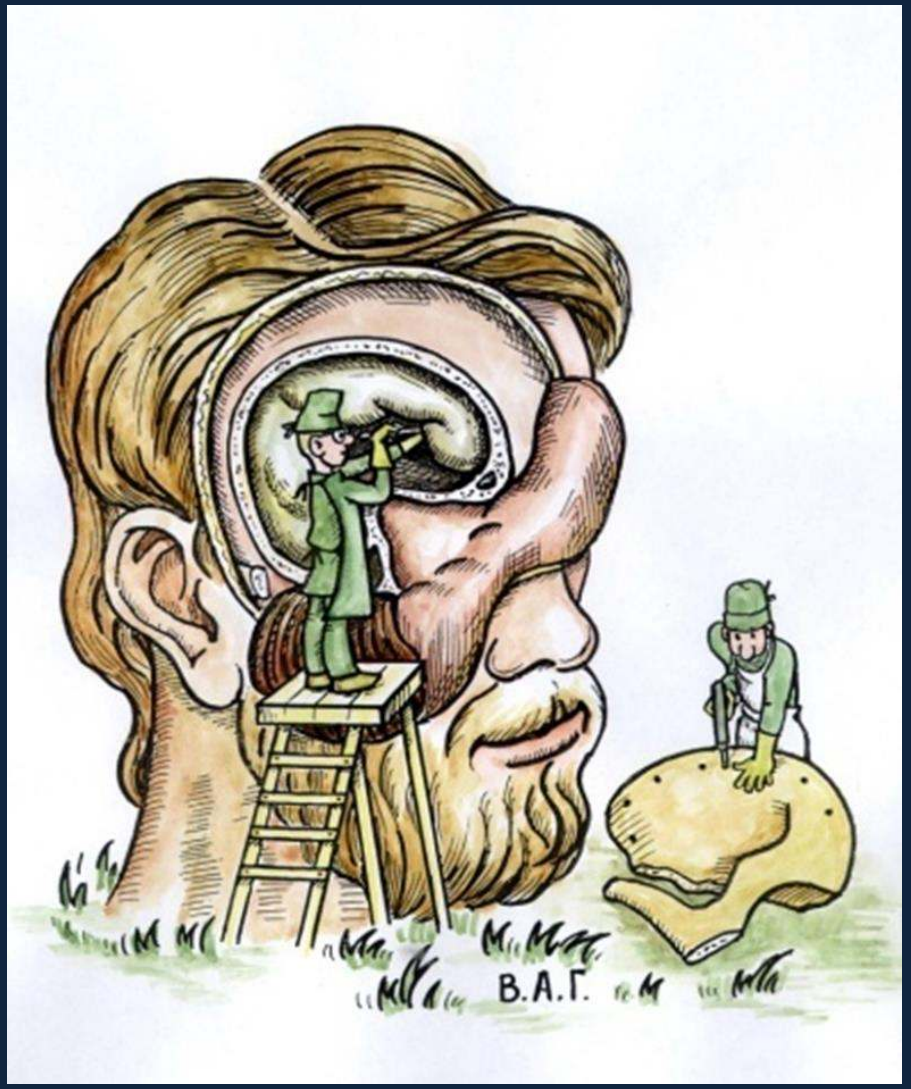
Minimal invasif

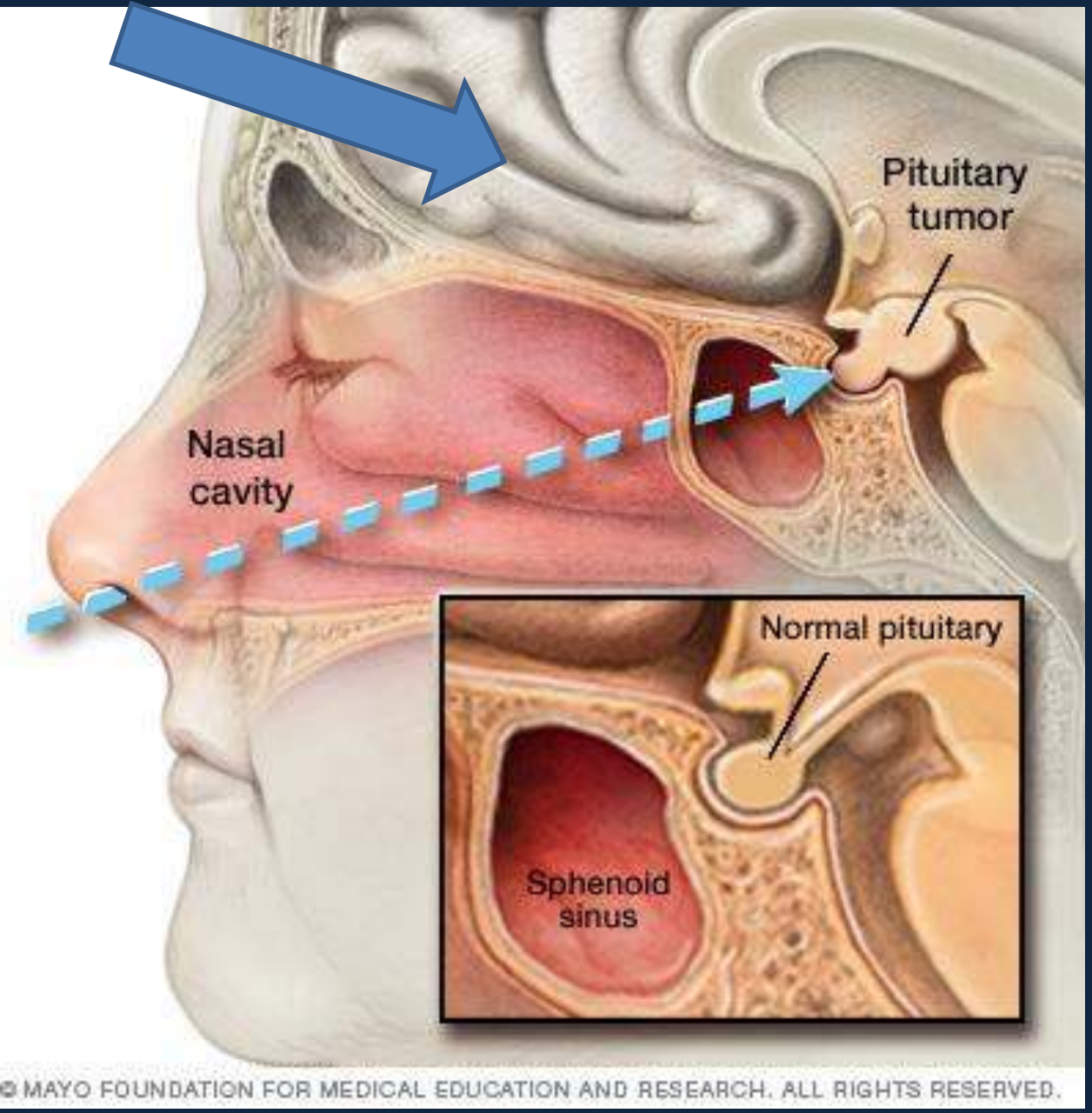
Endoscopic

Neurosurgery

Kraniotomi


Microadenoma
(4 mm)
Macroadenoma
(25 mm)
Giant
macroadenoma
(5 cm)


B.A.Г.



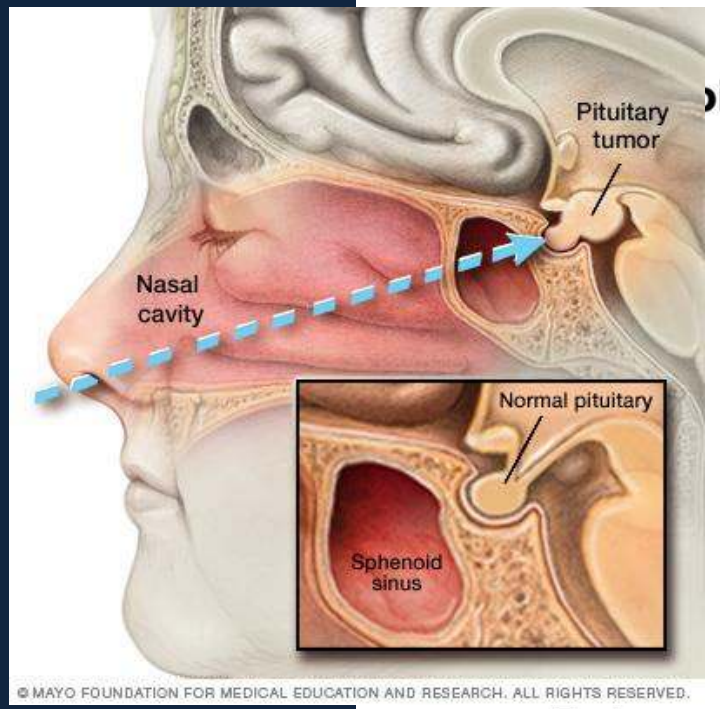
MINIMAL INVASIF

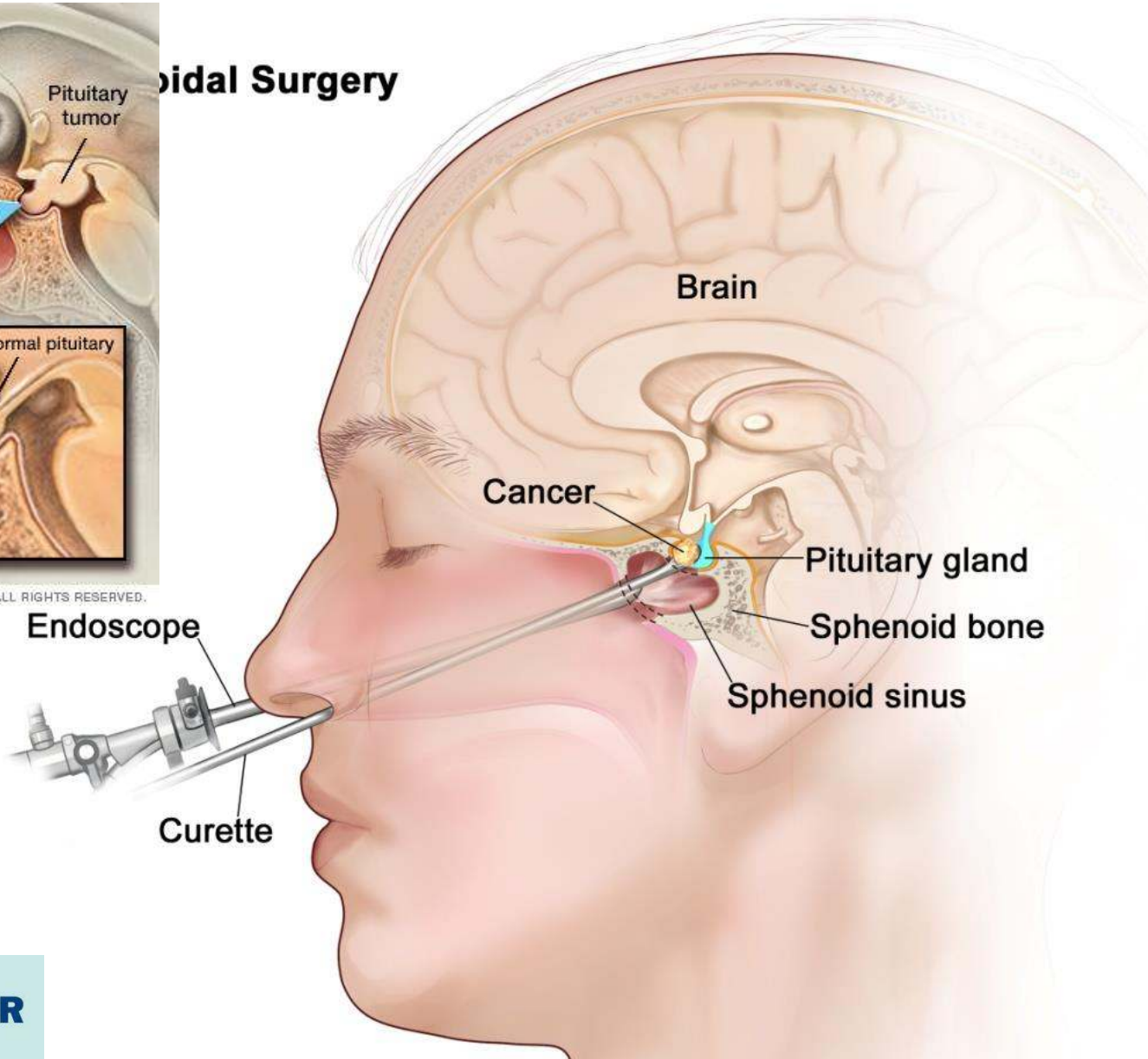
Endoskopi

Endonasal neurosurgery

BRAIN TUMOR & PITUITARY DISORDER CENTER

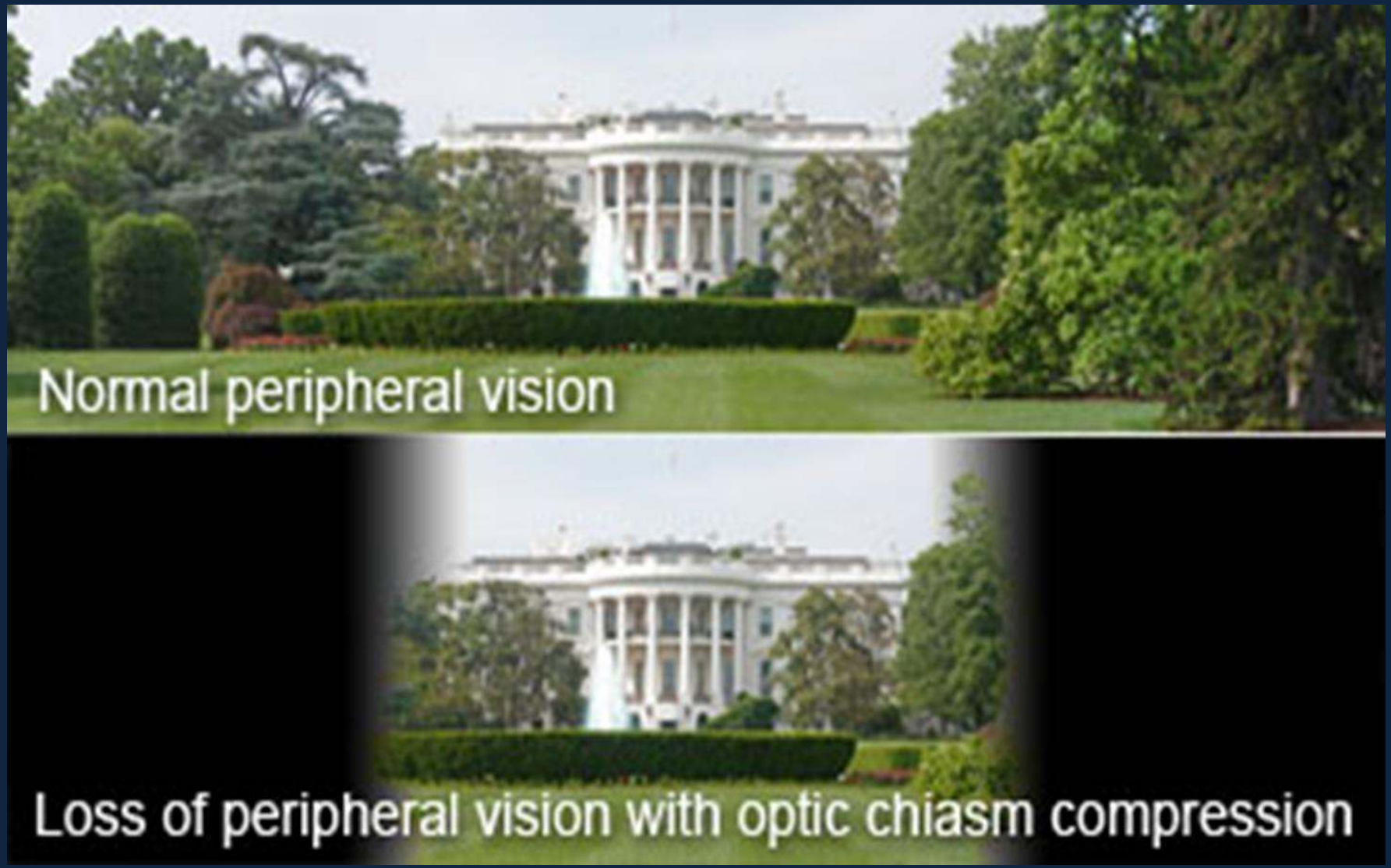
Endoskopi neurosurgery

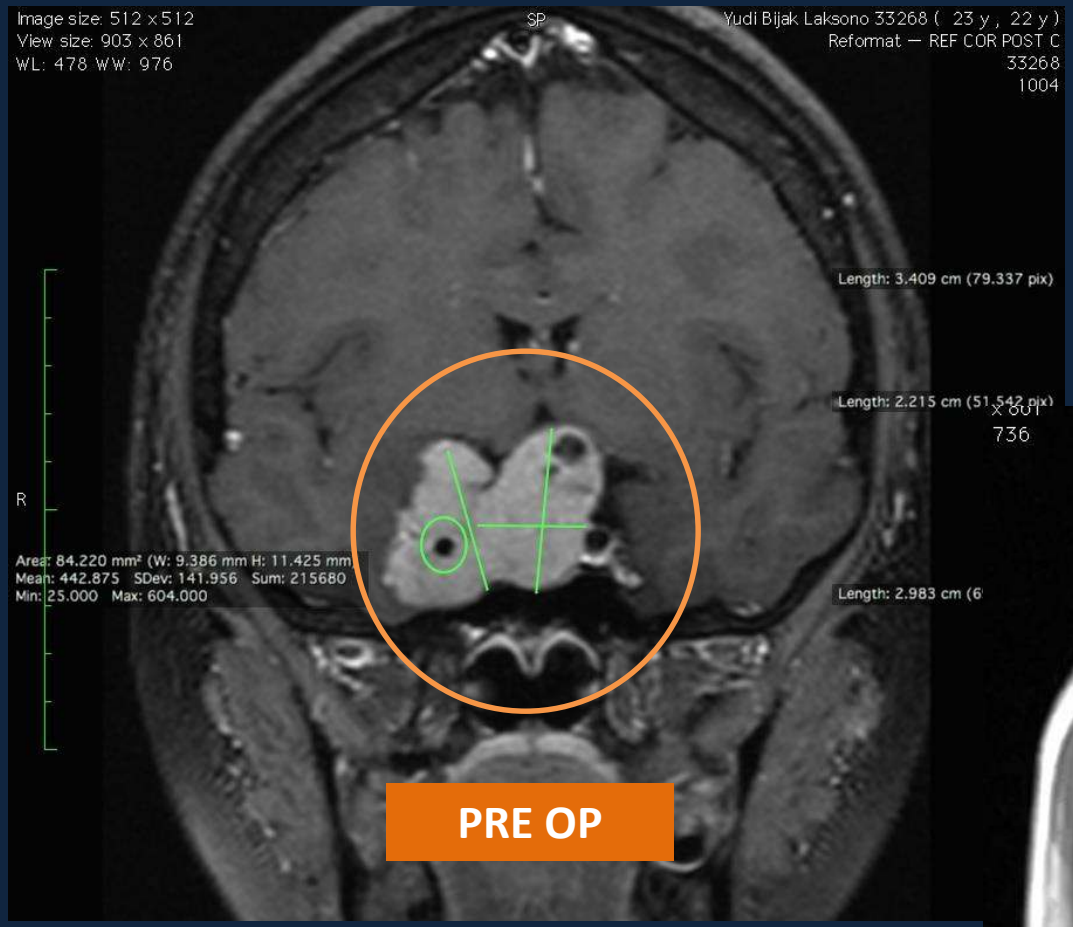


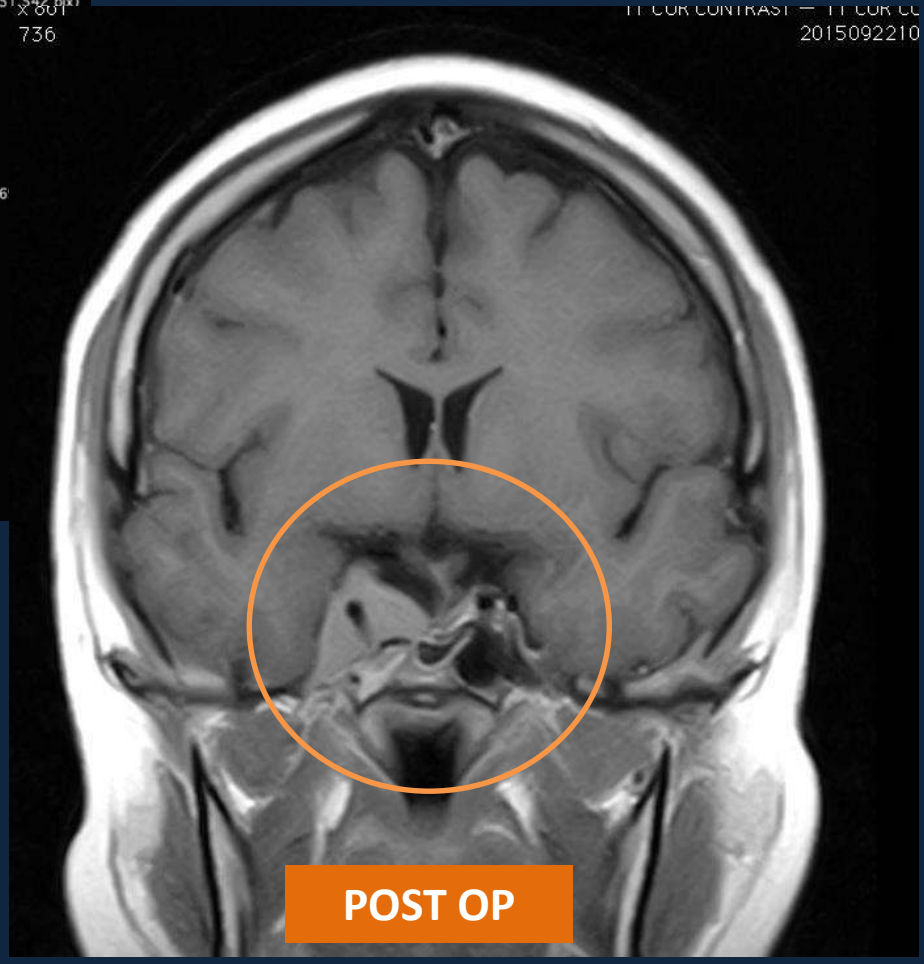


BRAIN TUMOR & PITUITARY DISORDER CENTER

Pria, 23 tahun,
Gangguan Penglihatan (LAPANG PANDANG)
Gangguan ereksi
Peningkatan Hormon PROLAKTIN

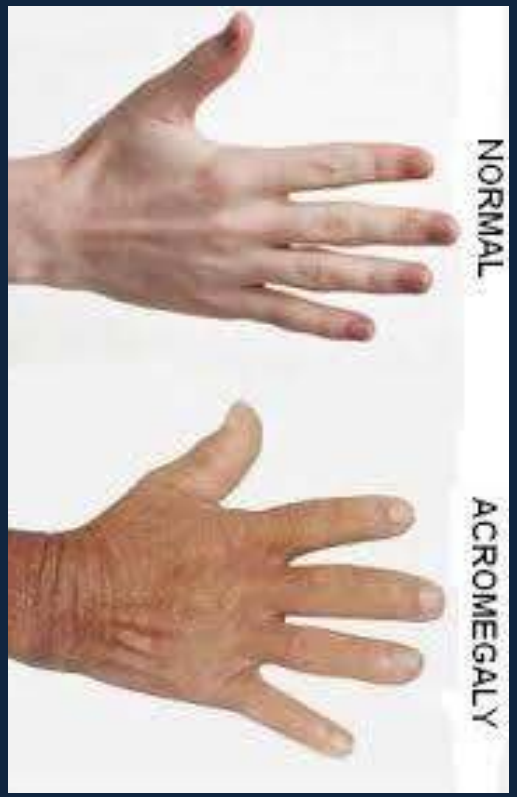


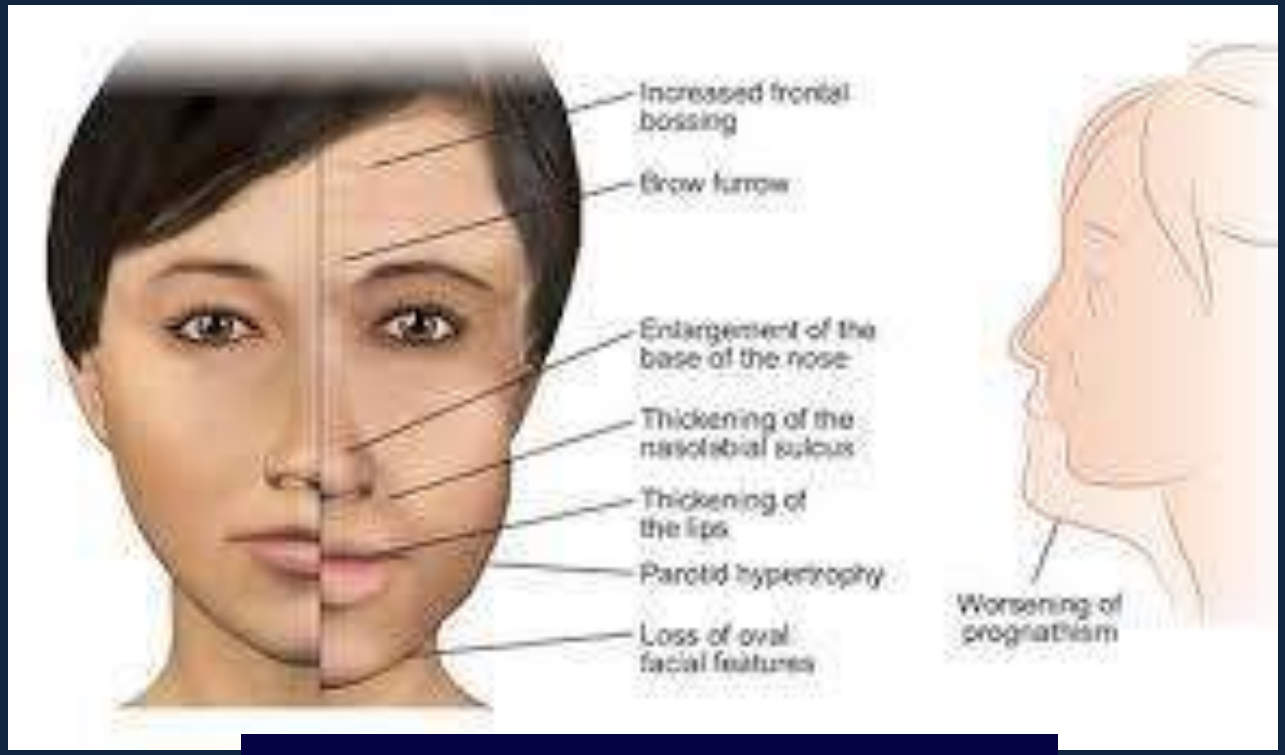




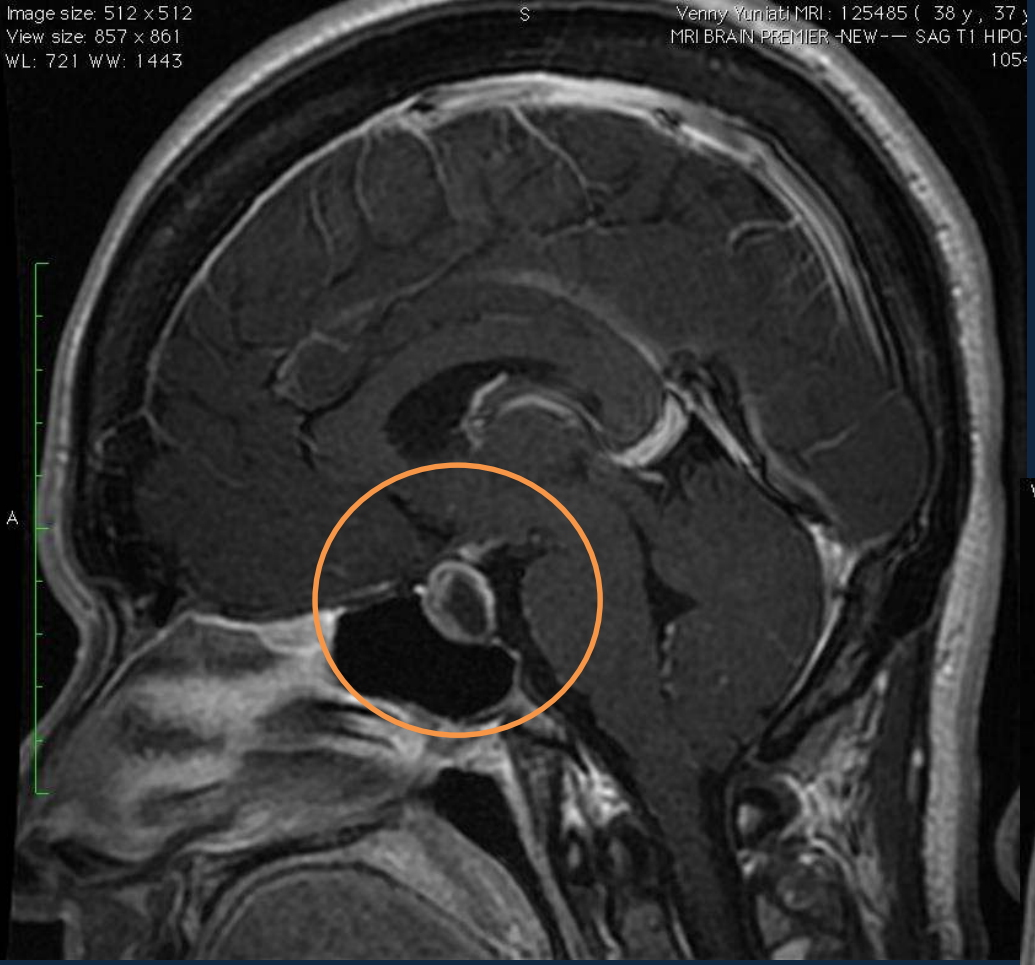
Pria, 23 tahun,
Gangguan Penglihatan (lapang pandang)
Gangguan ereksi
Peningkatan Hormon PROLAKTIN → PROLACTINOMA

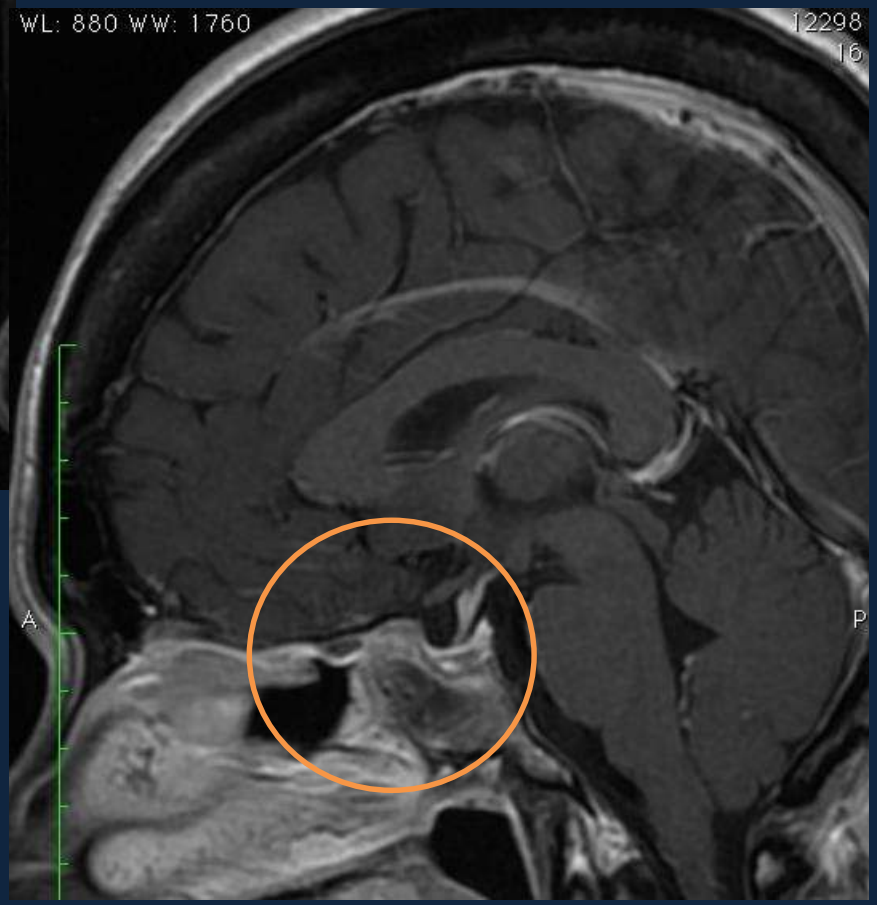
- Wanita, 34 tahun,
- gangguan menstruasi,
- tangan dan kaki makin membesar
- Peningkatan Hormon Pertumbuhan





ACROMEGALY

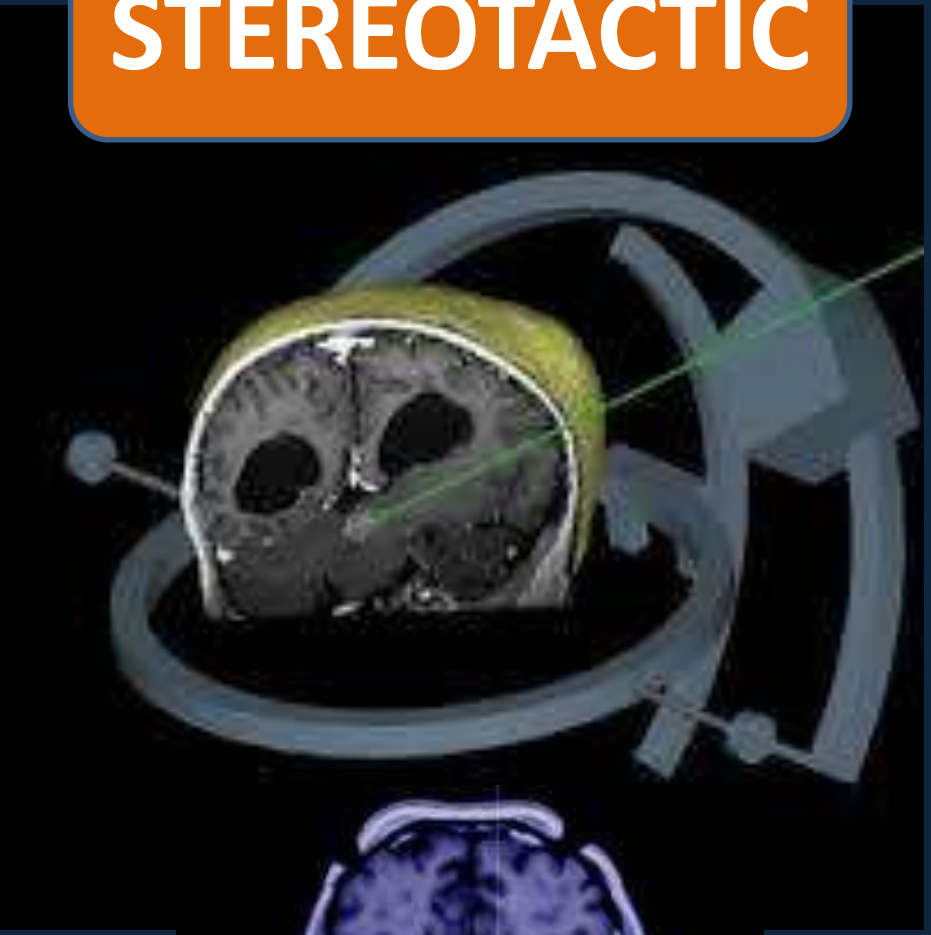


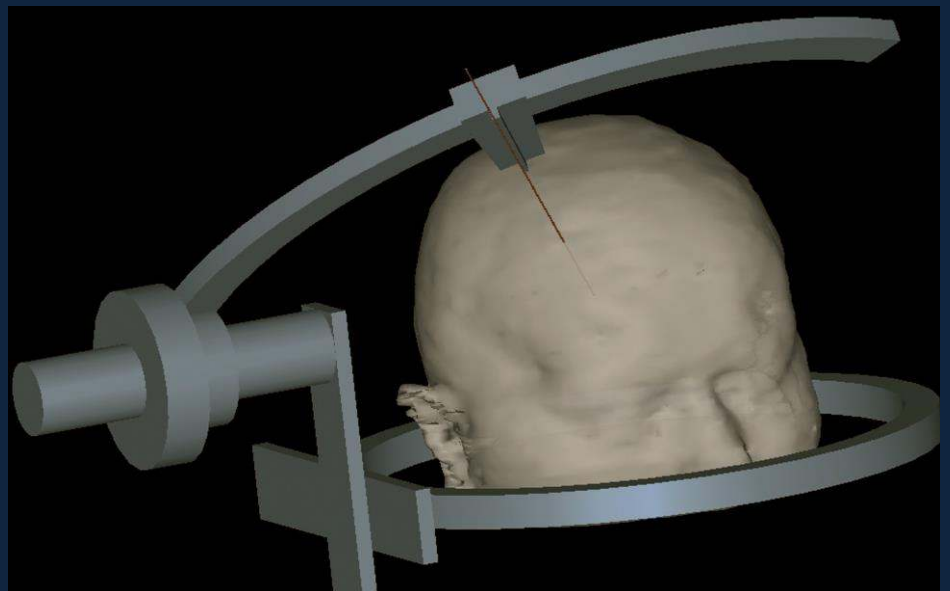


Wanita, 34 tahun,
gangguan menstruasi,
tangan dan kaki makin membesar
(ACROMEGALY)
Peningkatan Hormon Pertumbuhan

TUMOR OTAK
DI LOKASI YANG DALAM

STEREOTACTIC



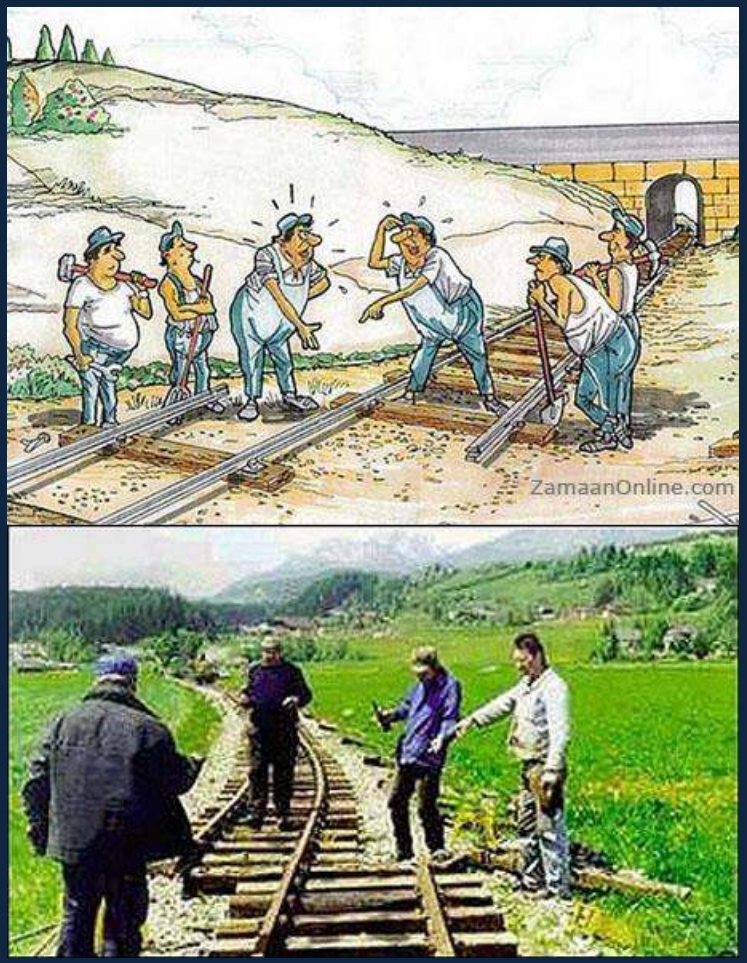


KEUNGGULAN TEHNIK MINIMAL INVASIVE

- Rasa sakit lebih sedikit
- Tidak ada / meminimalisir bekas luka pada wajah dan kulit kepala
  - Kosmetik
  - Scar minimal
- Masa pemulihan lebih cepat
  - **WAKTU DI RUMAH SAKIT LEBIH SINGKAT**

TIM DOKTER komprehensif:

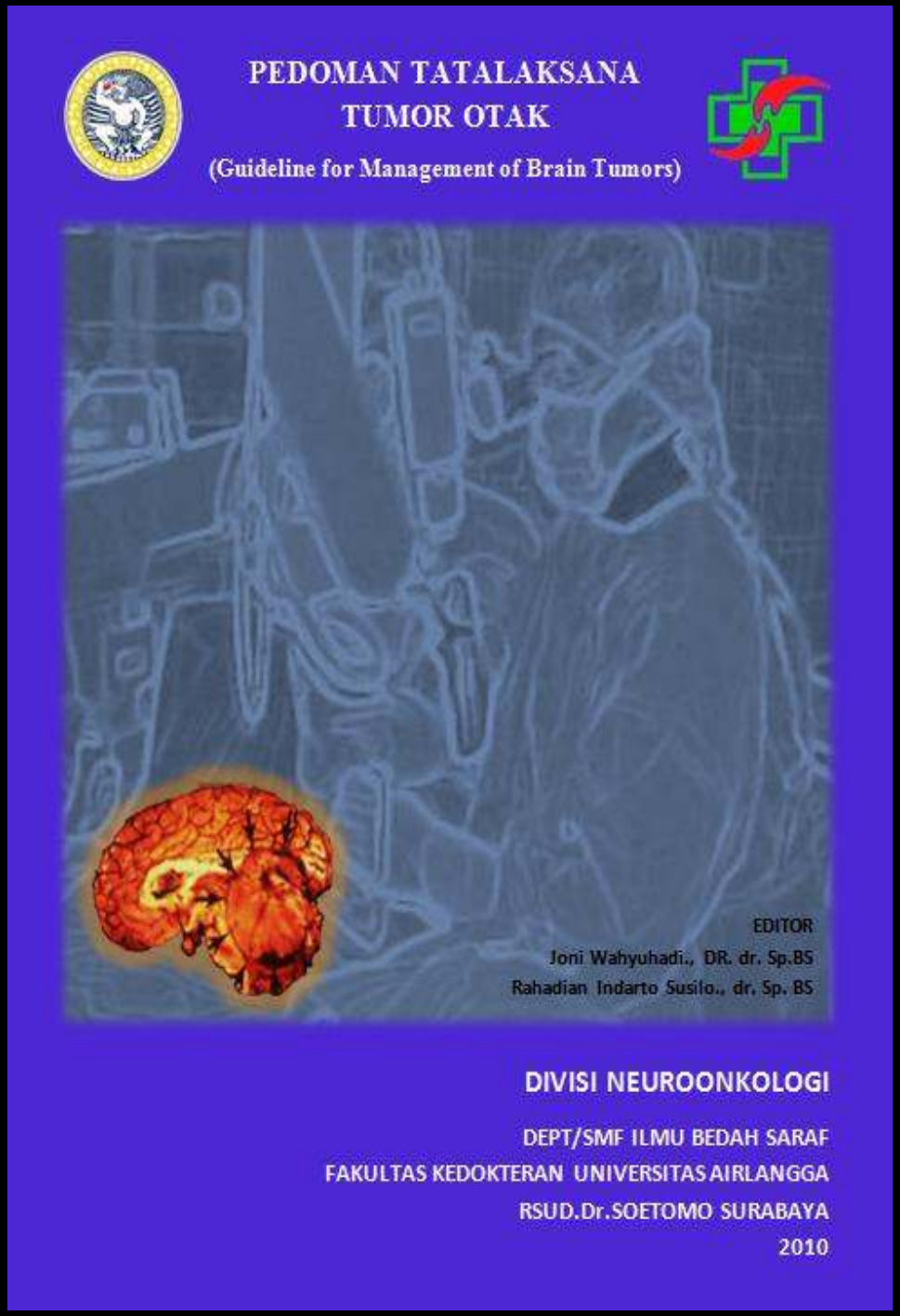
- Neurosurgeon
- Neurologist
- Endokrinologist
- Neuro – radiologist
- Neuro Patologist
- Ophthalmologist
- Medical Rehabilitation
- Perawat terlatih khusus



TERIMA KASIH

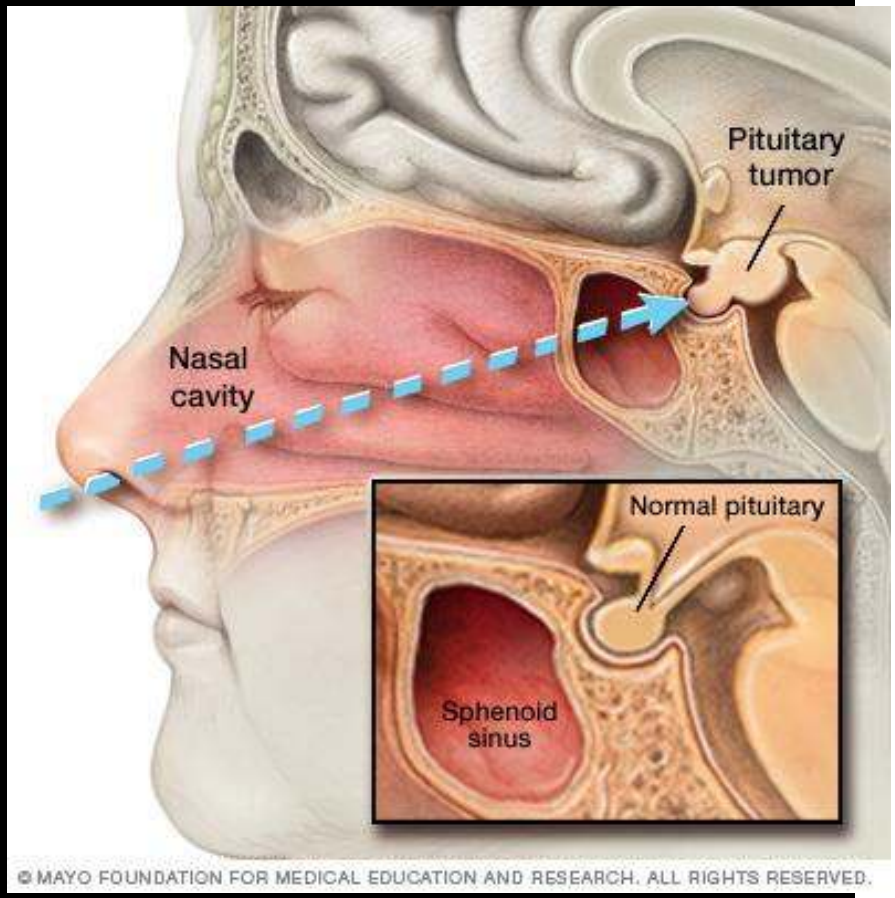
 # BrainTumorNetwork
 # BrainTumorIndonesia

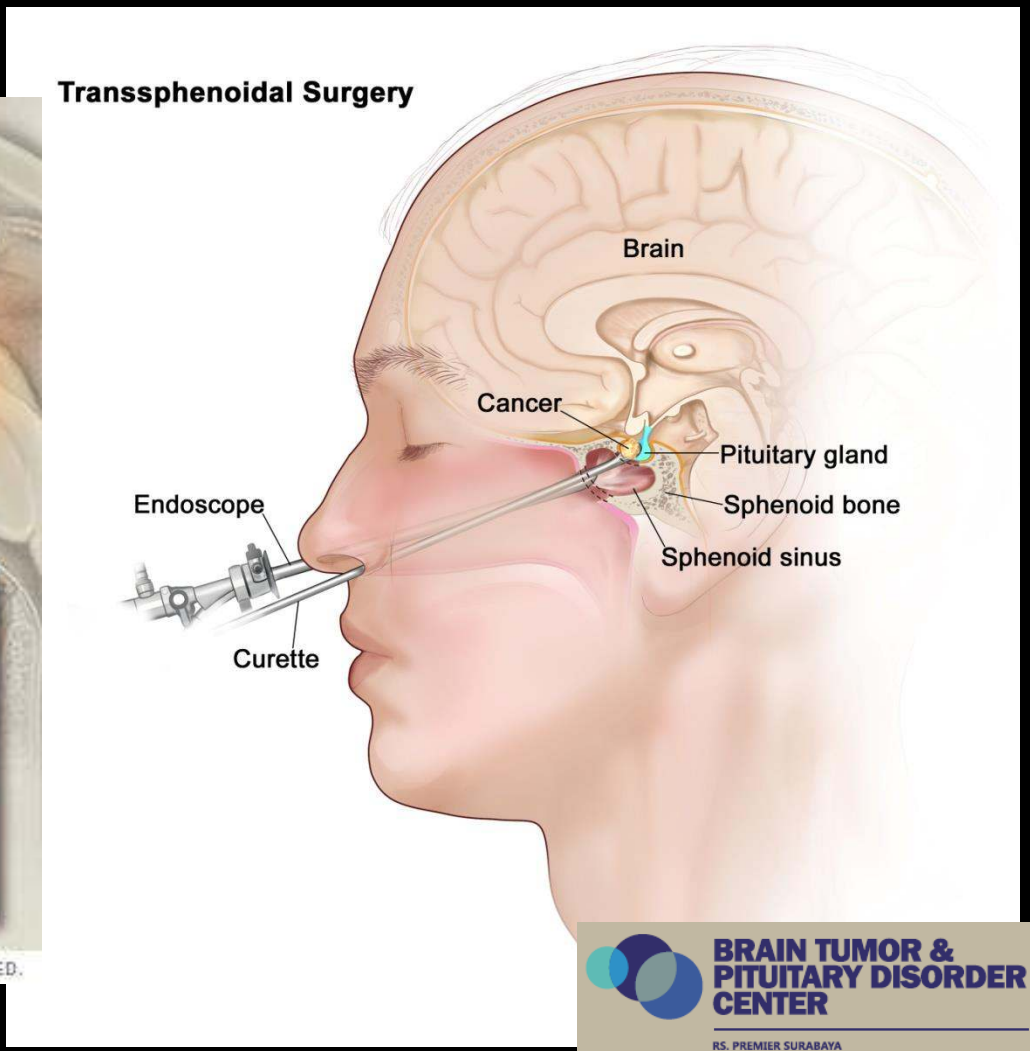
Our Guideline



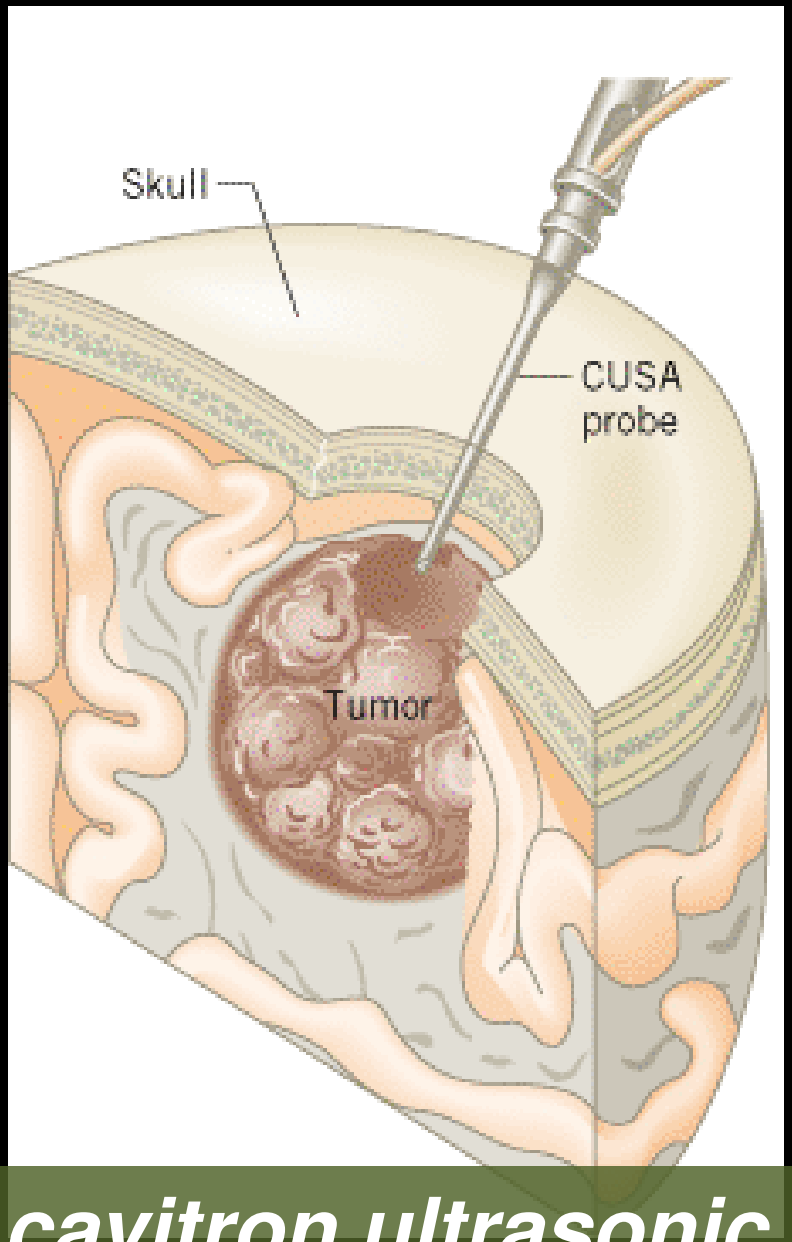
Microscope

Endoscopy neurosurgery





BRAIN TUMOR & PITUITARY DISORDER CENTER
RS. PREMIER SURABAYA



cavitron ultrasonic surgical aspirator (CUSA)

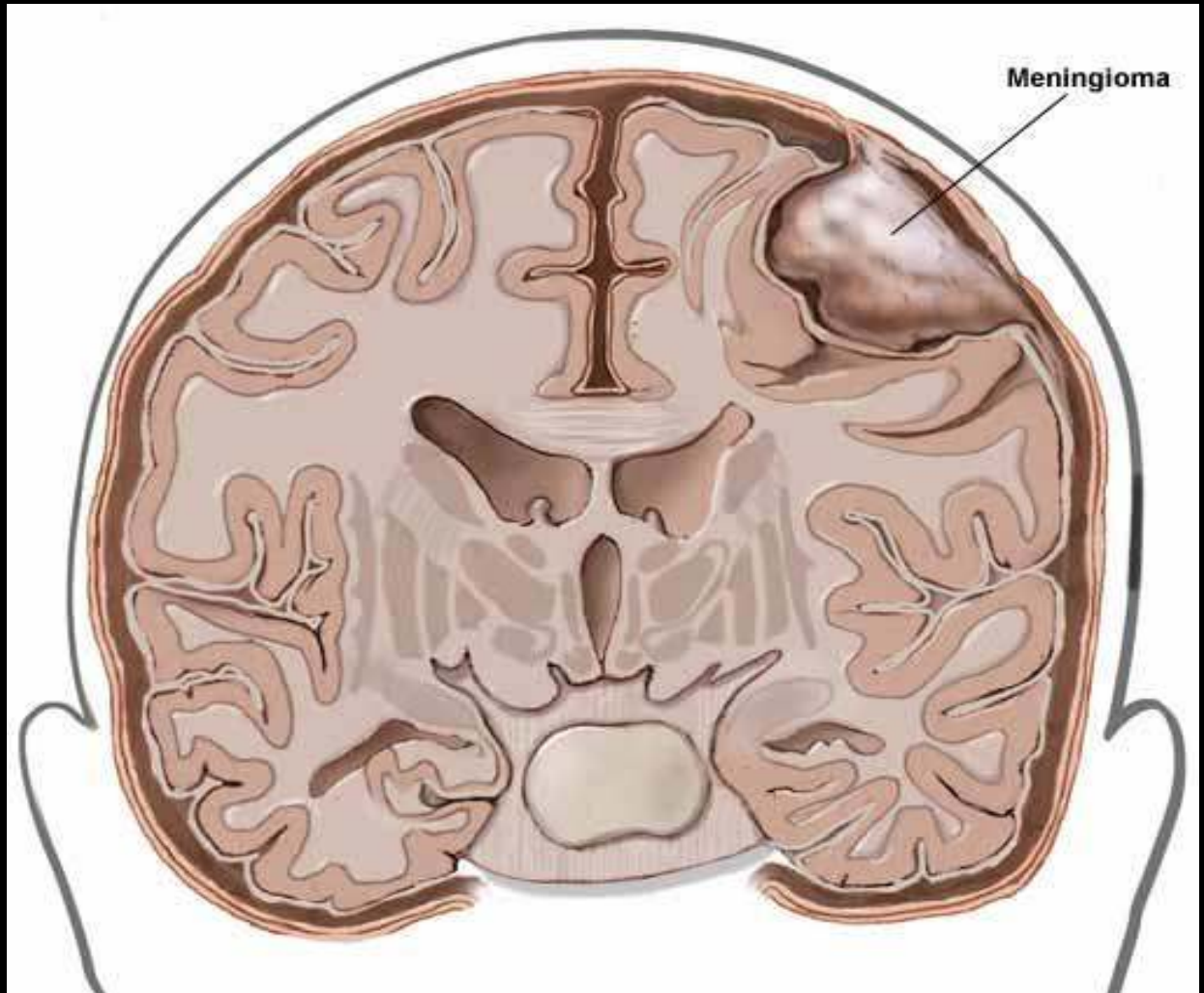
Intraoperative monitoring

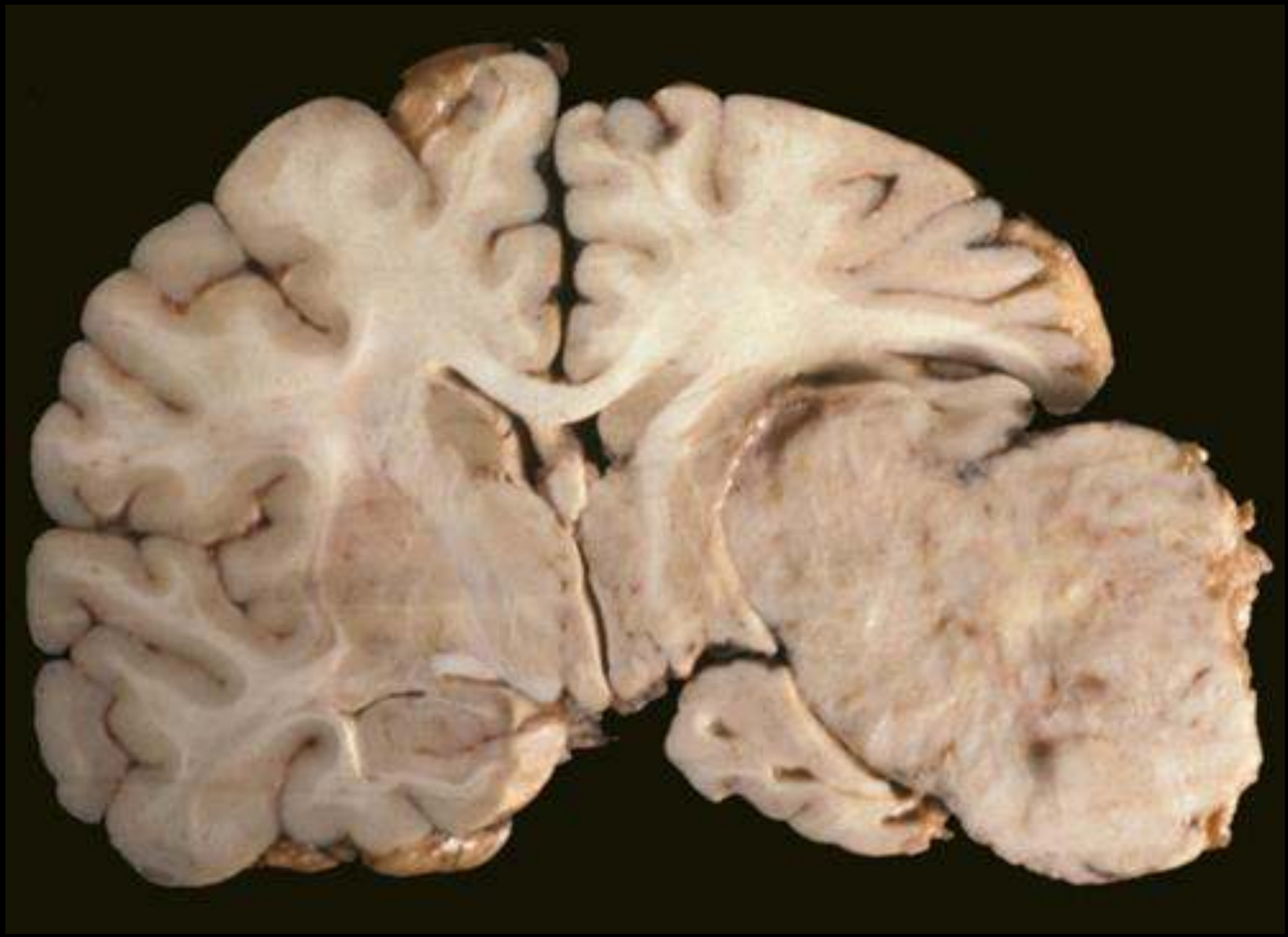
- Cranial nerve
- Brain Mapping
- Awake surgery

FOCUS

1. Meningoma
2. Astrocytoma
3. Metastase Brain tumor
4. Acoustic Schwanoma
5. Pituitary Adenoma

MENINGIOMA





Meningioma

- Origin : arachnoid cap cell → extra-axial tumor
- Slow growing
  - Incidental discovered meningioma → 32 % not grow over 3 yrs follow up
- Often produces hyperostosis of adjacent bone

Location

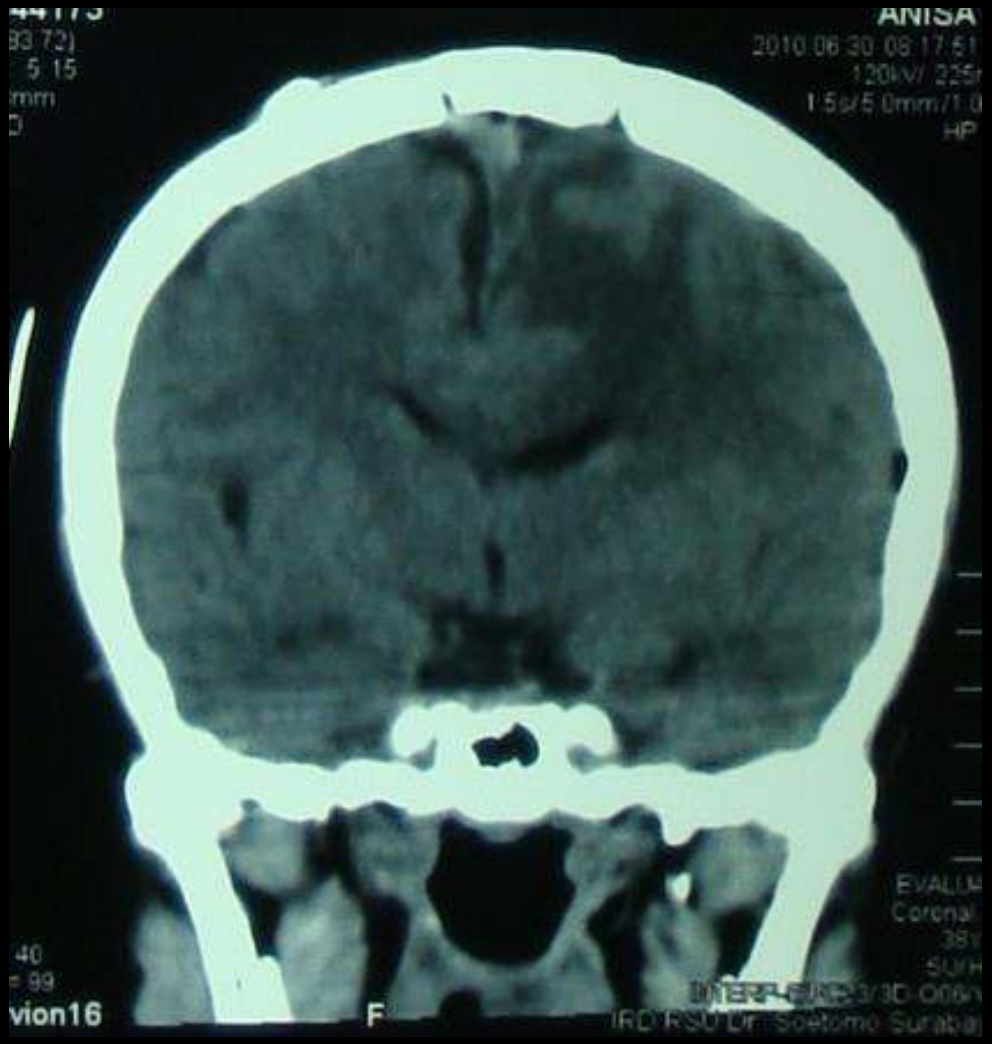
- Sphenoid wing (ridge) meningioma
- Parasagital and Falk meningioma
- Olfactory groove meningioma
  - Tumor > 3 cm → The morbidity, mortality and difficulty in achieving total removal increase significantly
- Planum sphenoidale meningioma
- Tuberculum sellae meningioma
- Foramen magnum meningioma
- Convexity

SURGICAL INDICATION

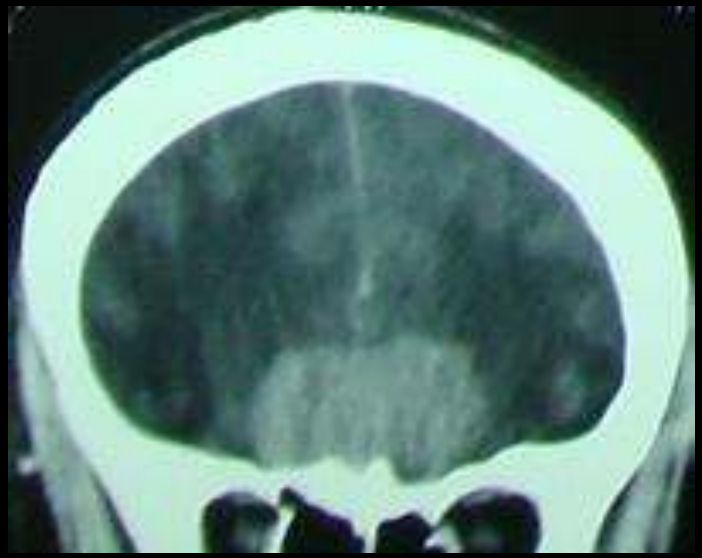
- :Documented growth on serial imaging
- Symptoms referable to the lesion that no satisfactory controlled medically
- **GOAL → complete removal**

(tumor + dural attachment + abnormal bone)

F 40 yo/ Parasagital meningioma



GROSS TOTAL REMOVAL



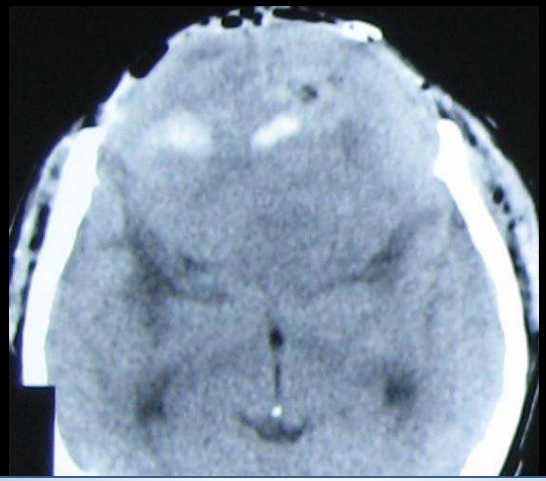
Olfactory Groove Meningioma

Tumor > 3 cm → The morbidity, mortality and difficulty in achieving total removal increase significantly

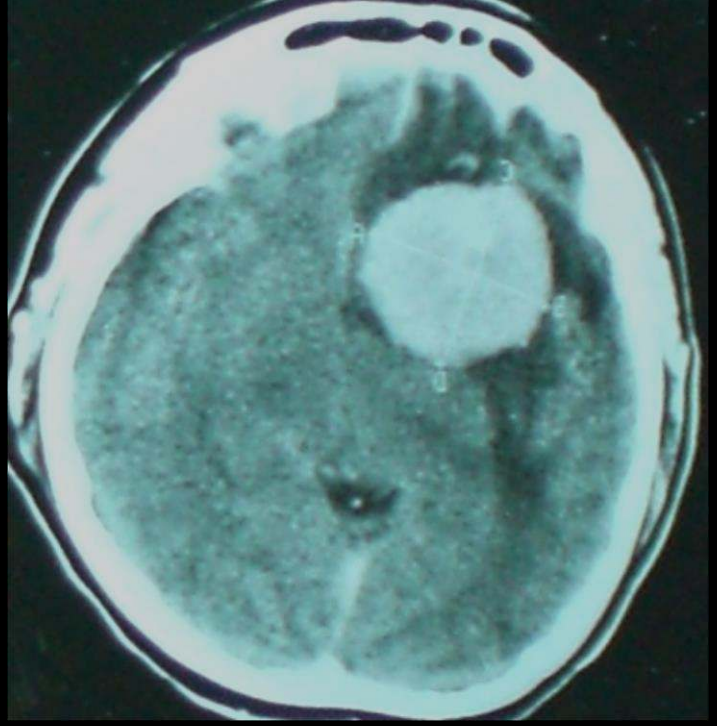
GROSS TOTAL REMOVAL

Olfactory Groove Meningioma meluas sampai ke posterior

Tumor > 3 cm → The morbidity, mortality and difficultyl increase significantly



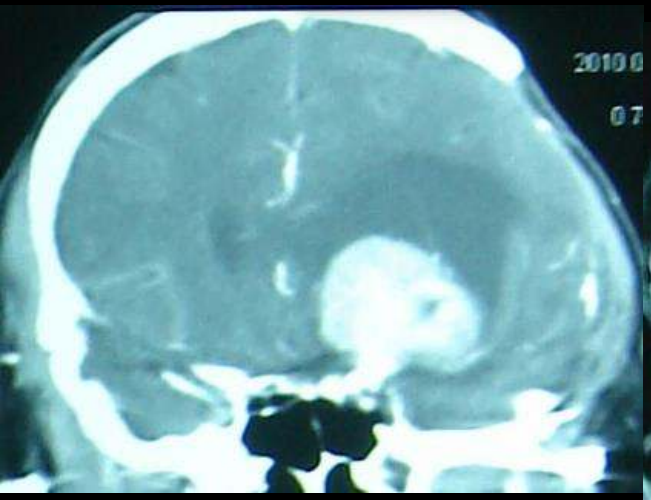
GCS menururn → Op. emergency at IRD → simple decompresi

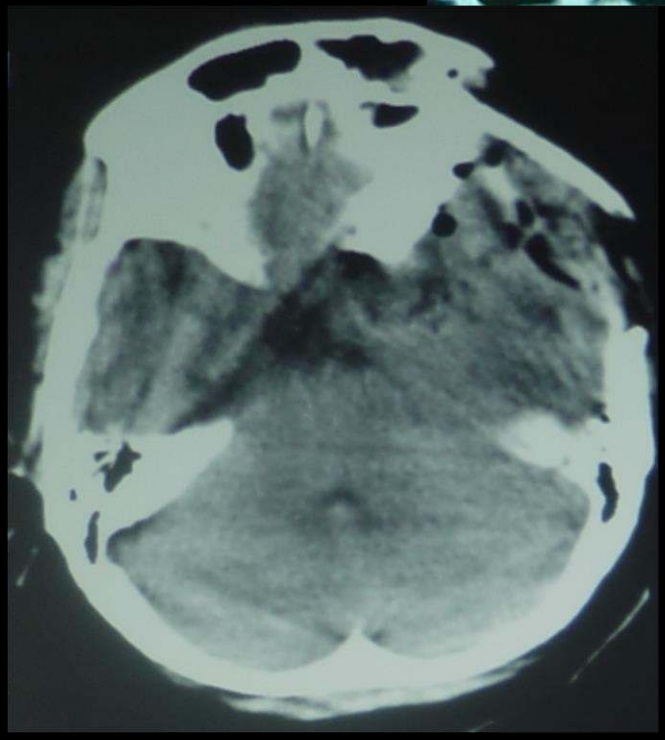


Sphenoid medial / clinoidal meningioma

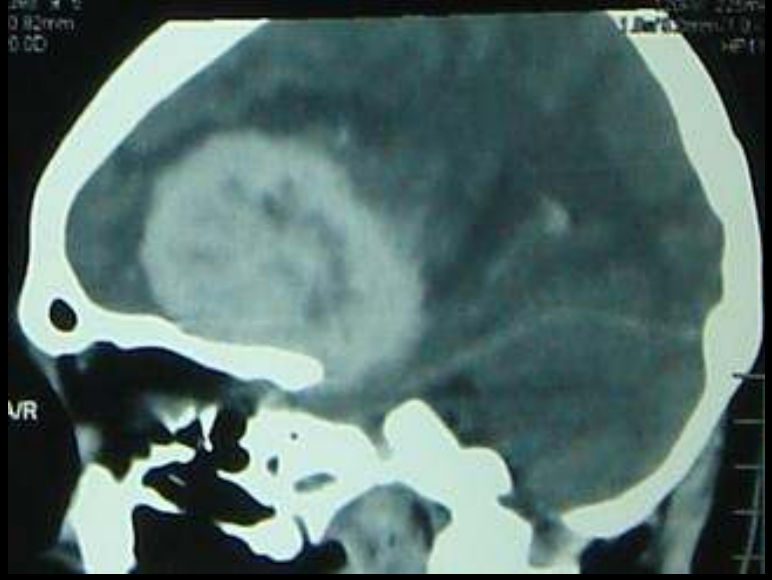
op I (in other institution)→only partial excision

RESIDUAL Sphenoid medial / clinoidal meningioma

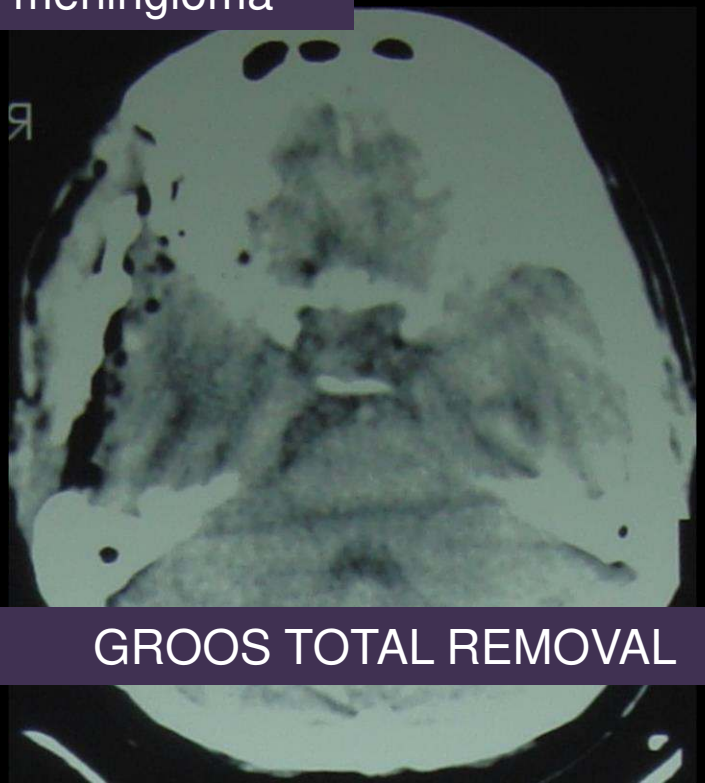




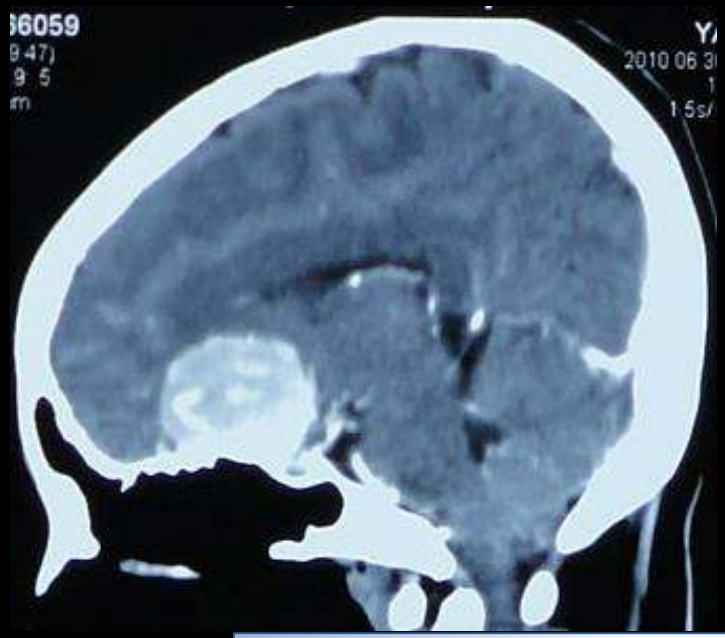
Re – operasi → Hasil op 2
→ groos total removal



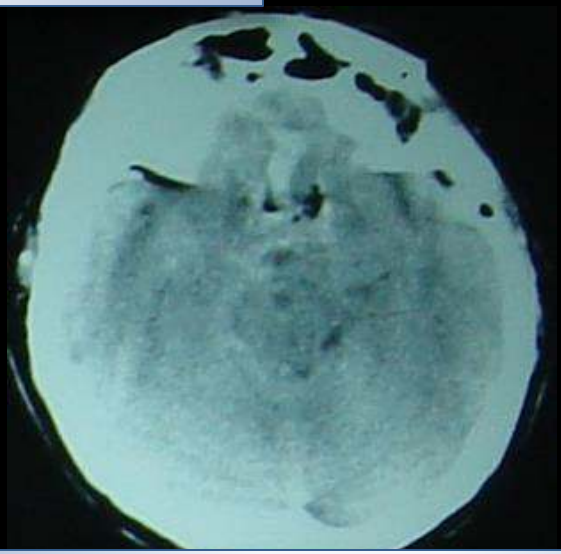
F 44 yo/ Sphenoid medial meningioma



GROOS TOTAL REMOVAL



TUBERCULUM SELLAE MENINGIOMA



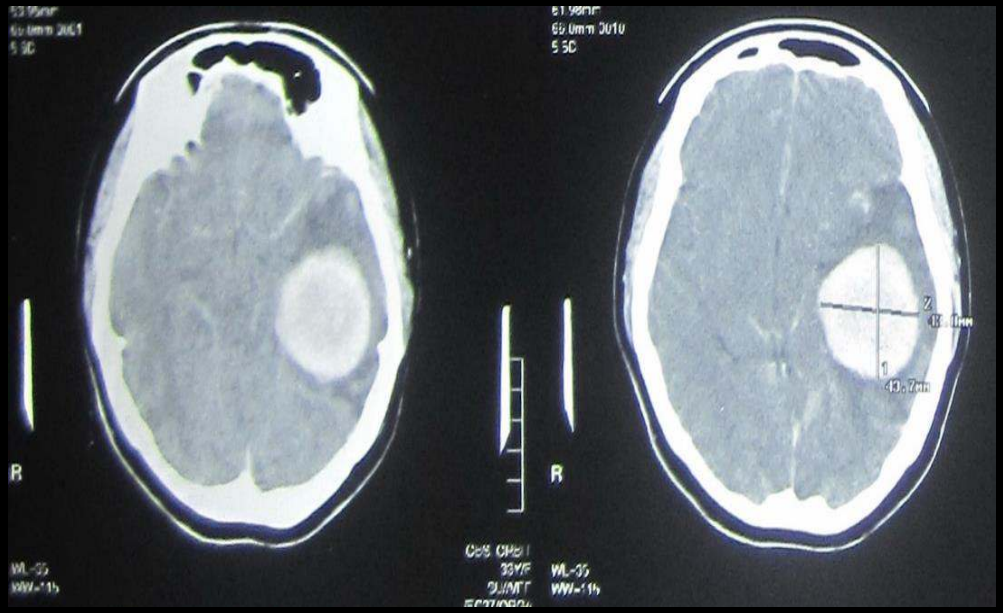
GROOS TOTAL REMOVAL

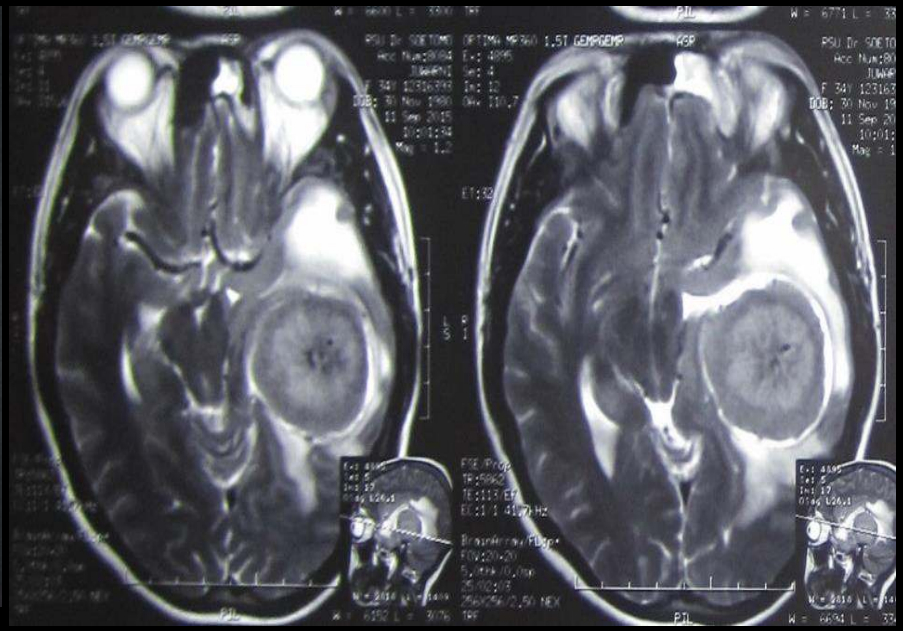
OPTIC SHEATH MENINGIOMA

Perempuan 50 th/ mata kiri menonjol sejak 3 tahun / GCS 15 Visus mata kiri Lp (-), Visus mata kanan 2/60

Post Op

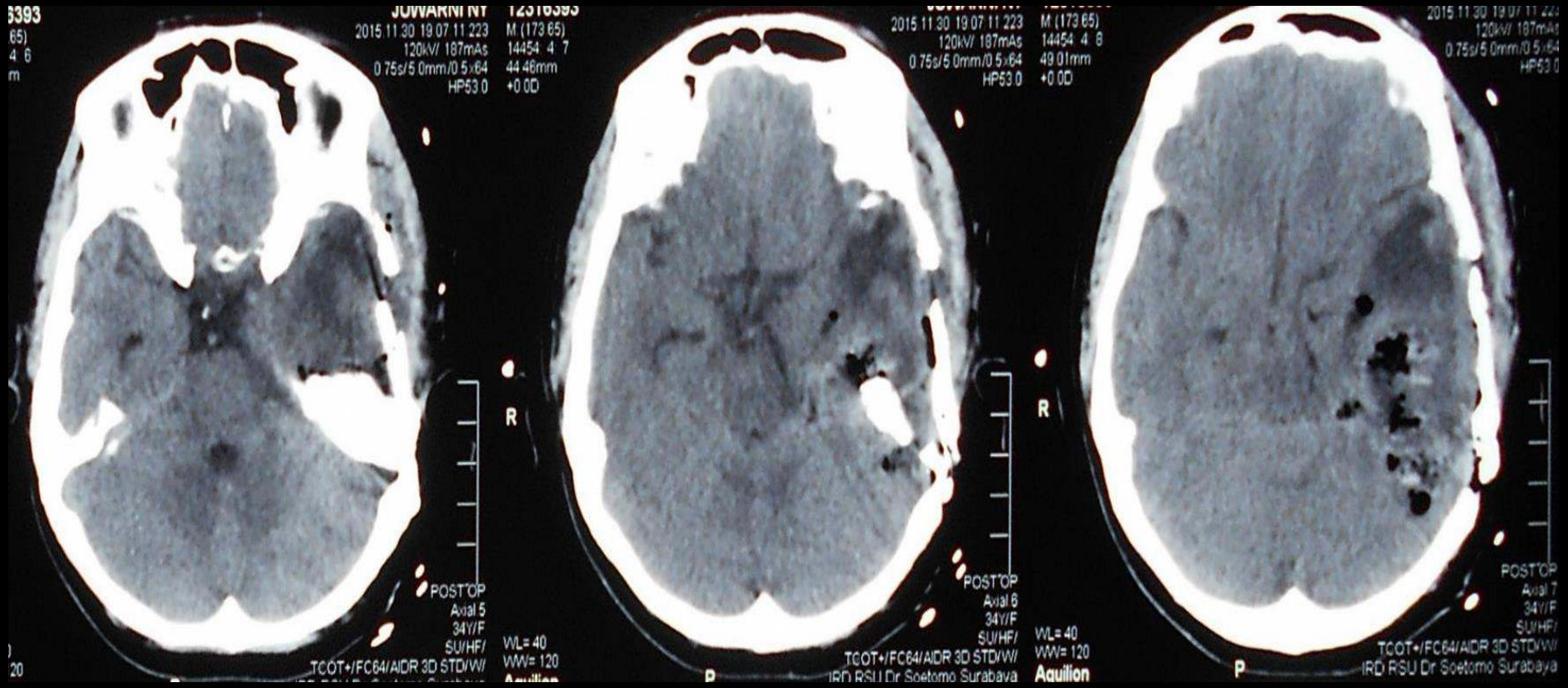
Meningioma Petrosal (S)



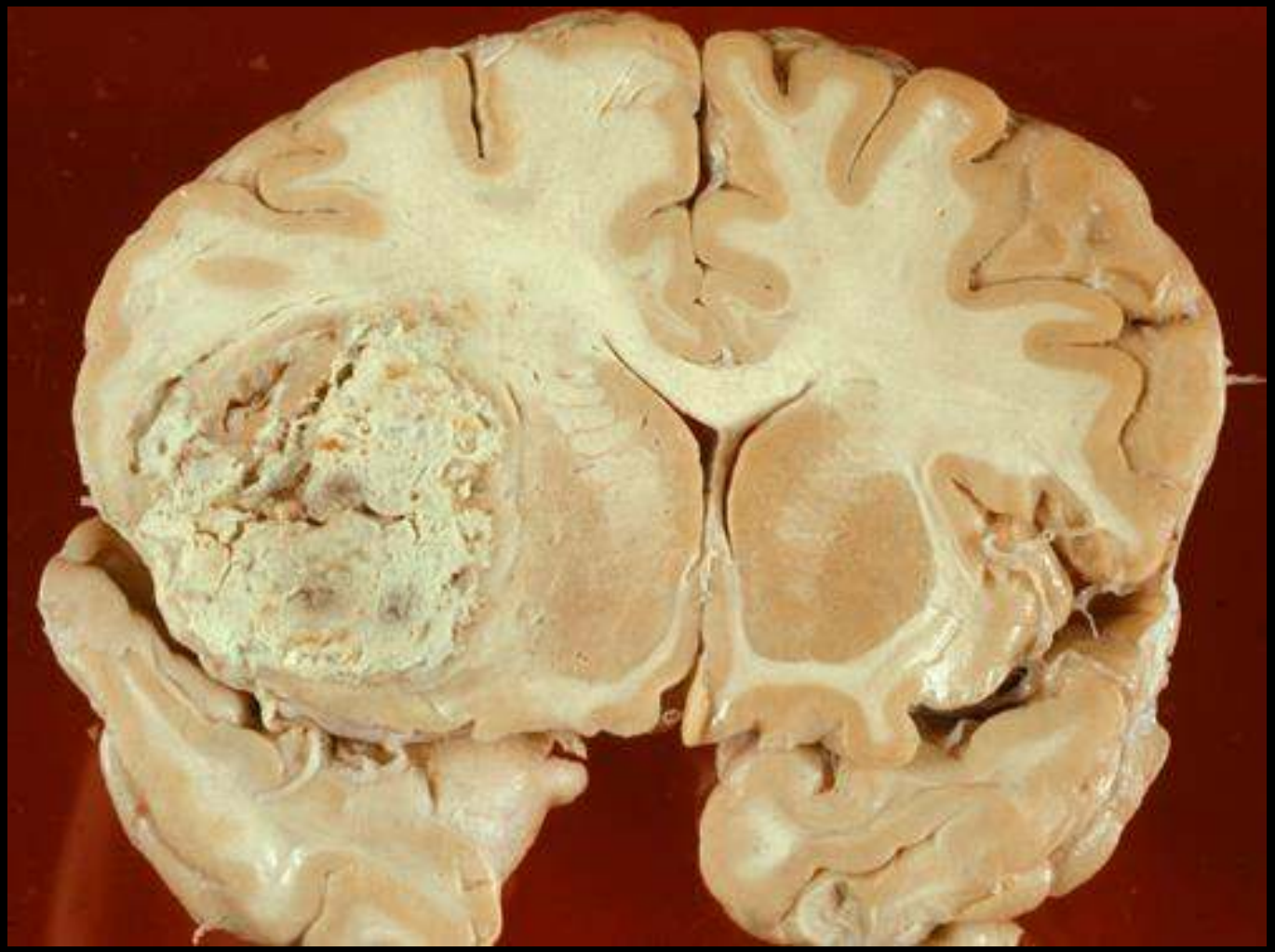


Perempuan 34 th/ pandangan mata kiri kabur sejak 6 bulan, nyeri kepala + / GCS 15 VOD 1/60, VOS 1/300, ODS early papil edema

Post Op


2015 11 30 19 07 11 223
120kV/ 187mAs
0 75s/5 0mm/0 5x64
HP53 0
+0 0D
POST OP
Axial 5
34Y/F
SU/HF/
TCOT+/FC64/AIDR 3D STD/WI/
WL= 40
WW= 120
Aquilion
R
P
2015 11 30 19 07 11 223
120kV/ 187mAs
0 75s/5 0mm/0 5x64
HP53 0
+0 0D
POST OP
Axial 6
34Y/F
SU/HF/
TCOT+/FC64/AIDR 3D STD/WI/
WL= 40
WW= 120
Aquilion
R
P
POST OP
34Y/F
SU/HF/
TCOT+/FC64/AIDR 3D STD/WI/
IRD RSU Dr Soetomo Surabaya
P

ASTROCYTOMA



Epidemiology

- **Most primary brain tumours are GLIOMA**
  - astrocytic
  - oligodendroglial
  - mixed astrocytic & oligodendrodial
  - ependymal neoplasms

- **Astrositoma**
  - The most invasive
  - Most commonly occuring brain tumors in all age

- Canada in 2008:
  - approximately 2550 cases (1450 men & 1100 women) diagnosed with primary brain tumours
  - 1,740 men and women will die of the same.

WHO Classification

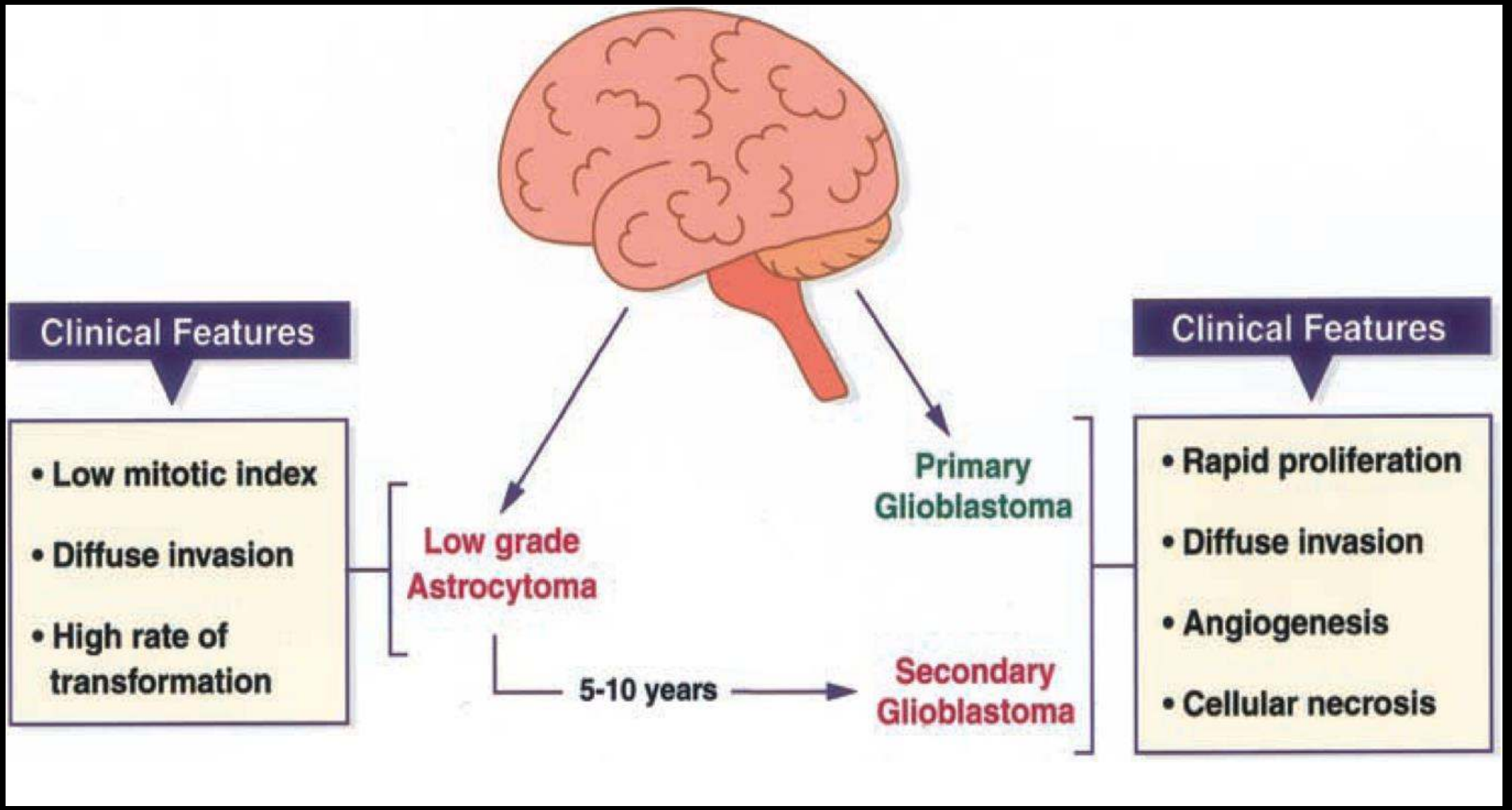
- Grade I (Pilocystic Astrocytoma)
  - Most frequent brain tumors in children
- Grade II (low grade Astrocytoma)
  - 25% of glioma & infiltrative

Low grade

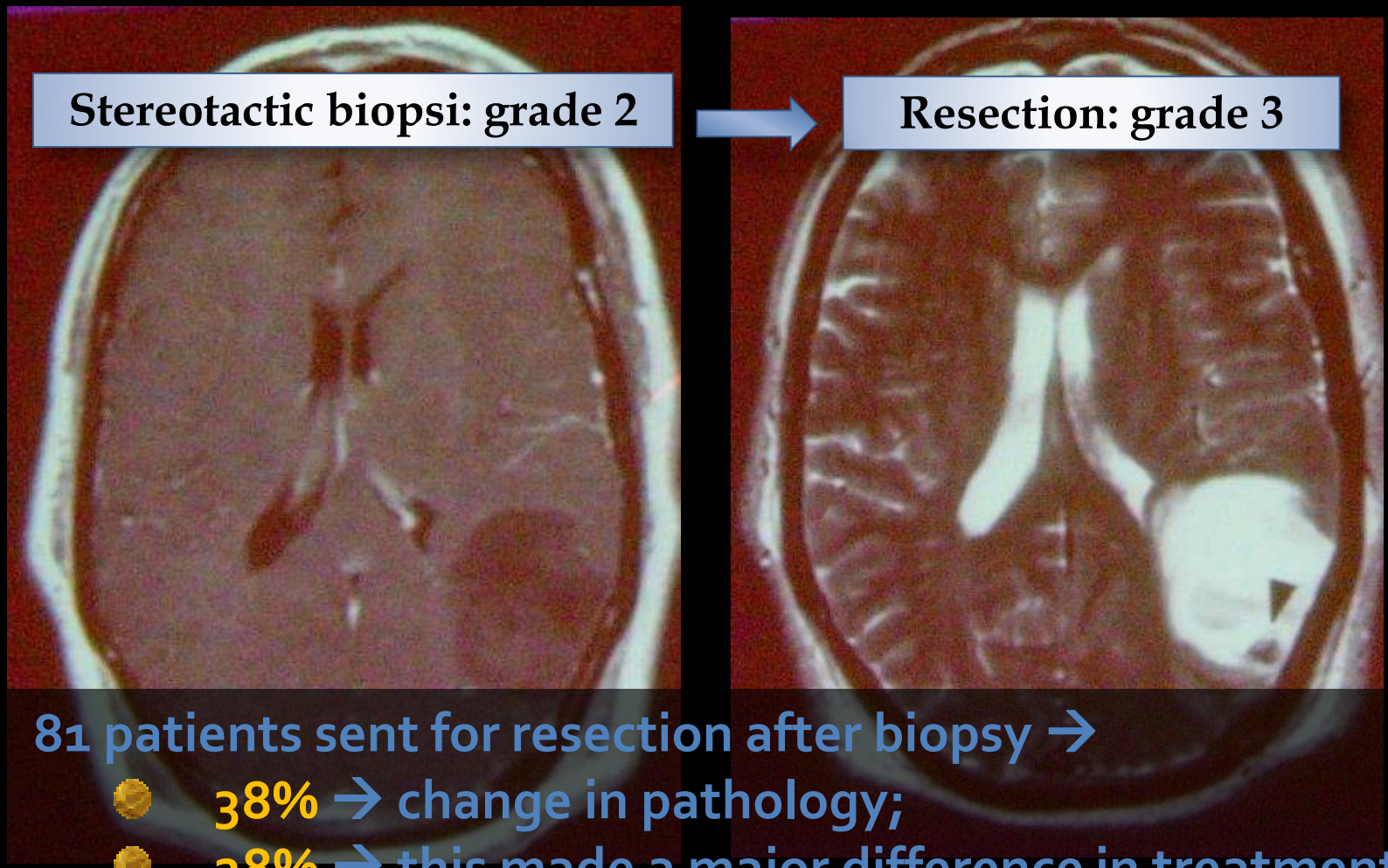
- Grade III (anaplastic Astrocytoma)
  - Highly malignant , progress to GBM
- Grade IV (glioblastoma multiforme)
  - Highly malignant, poor prognosis
  - rapid spread to other region of the brain

High grade

Clinical features



Making an accurate diagnosis



81 patients sent for resection after biopsy →

- 38% → change in pathology;
- 28% → this made a major difference in treatment

Jackson et al, Neuro-Oncology 2001

Major Prognostic Factors

- Age
- Karnofsky Performance Score
- Histological type
  - (oligodendroglial, mixed or astrocytic)
- Tumour grade
  - (WHO grade III or IV)

OTHER Prognostic factors :

- The extent of resection
- The location and volume of the tumour.

3 months

F/ 36 yo

Treatment

MULTIDISCIPLINARY

→ OPTIONS :

- No treatment → observation
- Surgery
- Radiation
- Chemotherapy

Tx High grade glioma

- **Surgery is the initial recommended approach** in suspected high grade gliomas,

- **Goal of surgery**
  - debulking,
  - clinical improvement
  - pathologic diagnosis
  - SET UP OTHER THERAPIES

SURGERY : RESECTION vs BIOPSY

Surgery

- Surgical resection as the main treatment for
  - alleviation of symptoms and
  - prolongation of life
- Most studies report a survival advantage for resection over biopsy
  - Alberta Cancer Board, Clinical Practical Guideline, Management of Glioblastoma Multiforme, 2009
- **Recommendation:**
  gross total resection, when safe,
  in high grade gliomas
  (WHO grade III and IV).

Adjuvant Tx

- **Adjuvant chemo-radiation tx:** the standard of care following surgery.
- Whenever possible, surgery will be
  - followed by adjuvant **combined Temozolomide-based chemotherapy and radiation** → "Concurrent Treatment"
  - followed by adjuvant **Temozolomide for a total of 6 to 12 cycles.**

"Concurrent Treatment"

- low dose of chemotherapy (temozolomide) daily during radiation therapy
- With this approach survival at 2 years improved from 10% to 26%.
- Determination of MGMT may assist in determination of prognosis

"concurrent treatment" followed by monthly temozolomide cycles (six monthly cycles of temozolomide administered 5 days every 28 days) is the standard of care for patients with GBM.

Local delivery

- Deliver therapy directly to the tumor site
- increase efficacy
- Reduce side effects of systemic therapy
- Use less of the therapeutic drug
- Delivery drug continuously, and increase patient compliance

Elderly Px

- Elderly patients (≥60 years old)
  with a poor performance status (KPS ≤70) → adjuvant radiation tx alone,
  with or without tissue diagnosis

- Radiation Tx→ abbreviated to 40 Gy in 15 fractions

Low Grade Glioma

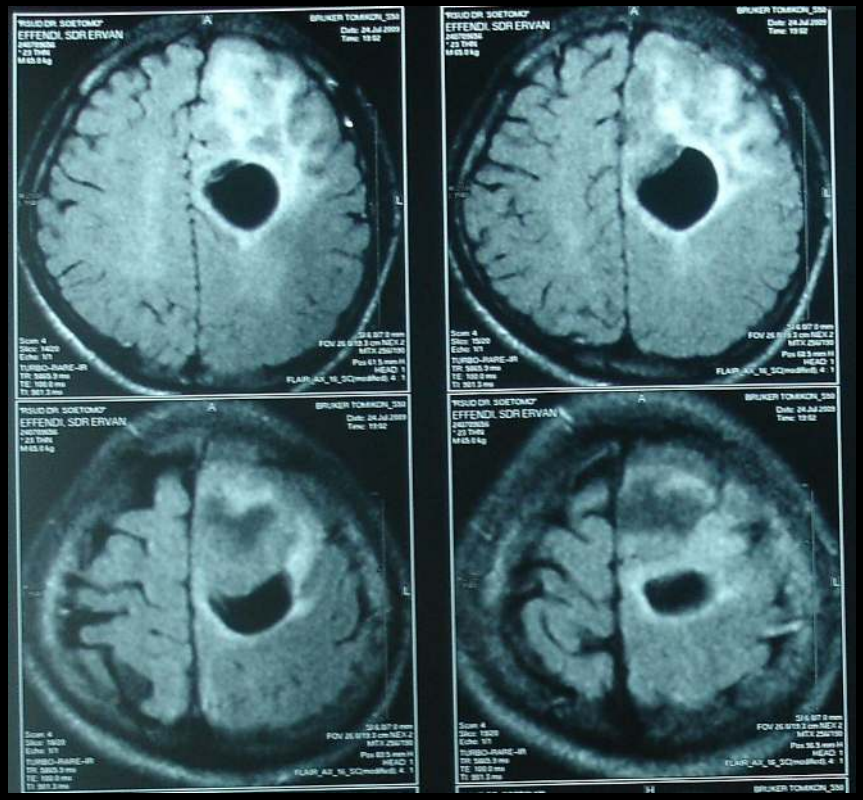
- Treatment → controversial
- requires a multidisciplinary approach which can include surgery, radiation therapy, and chemotherapy.
- Survival & respons rates are related to
  - Tumour type
    - Oligodendrogliomas or oligo- dominant mixed histology has better survival
  - Size (smaller size associated with better survival)
  - Age of the patient (younger is better),
  - Mental status

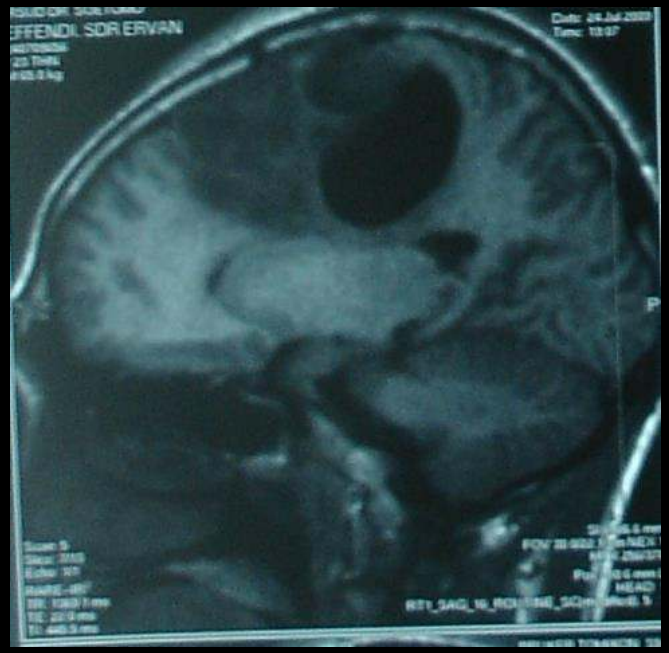
Tx Low Grade Glioma

- In patients with low grade glioma and controlled epilepsy as the single symptom, surgery may be deferred until clinical or radiological progression

- **maximal resection (when safe) if →**
  - In patients with increased intracranial pressure,
  - neurological deficits,
  - uncontrollable seizures,
  - clinical or radiological progression,

Tumour location →principal factor determining resectability





M/ 29 y.o/ GCS 15/ seizure & slight hemiparesis
Diffuse astrocytoma (WHO Grade II)

Radiotherapy in Low Grade Glioma

- **Postsurgical radiation therapy**
  - may be deferred until clinical or radiological progression
- When Radiation therapy is indicated, the dose should be between **45 and 54 Gy**

Chemotherapy in Low Grade Glioma

- Chemotherapy **should not be added** to radiation therapy
  - the combination shows no benefit in comparison to RT alone
  - increases the toxicity.
- Chemotherapy such as temozolomide may be offered in patients with **progressive tumours that harbour combined 1p/19q loss of heterozygosity.**

Difuse Astrocytoma (WHO grade II)

F/ 39 y.o
GCS 15
Headache

The “high risk“ low grade glioma

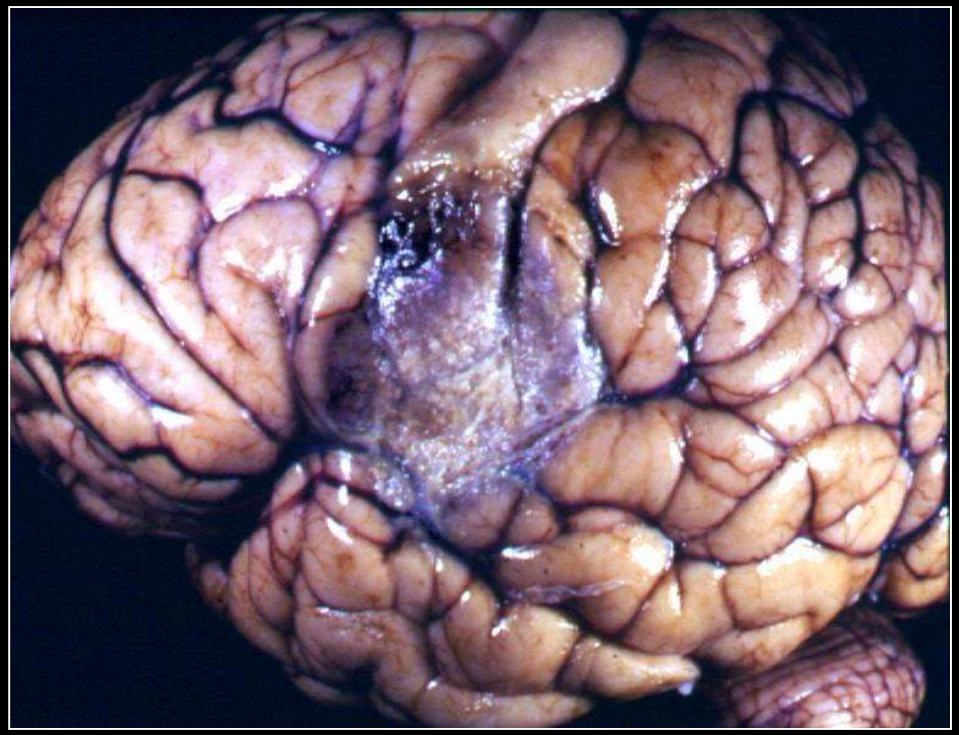
- Meet at least three of the following criteria :
  - Age ≥40 years,
  - Largest preoperative tumor diameter ≥6 cm
  - Tumor crossing midline
  - Tumor of astrocytoma histology
  - Preoperative neurologic deficits (Neurologic Function Score >1)
- Tx → temozolomide concurrently with RT followed by 12 cycles of 4-weekly chemotherapy.
  - There is currently an ongoing phase II clinical trial

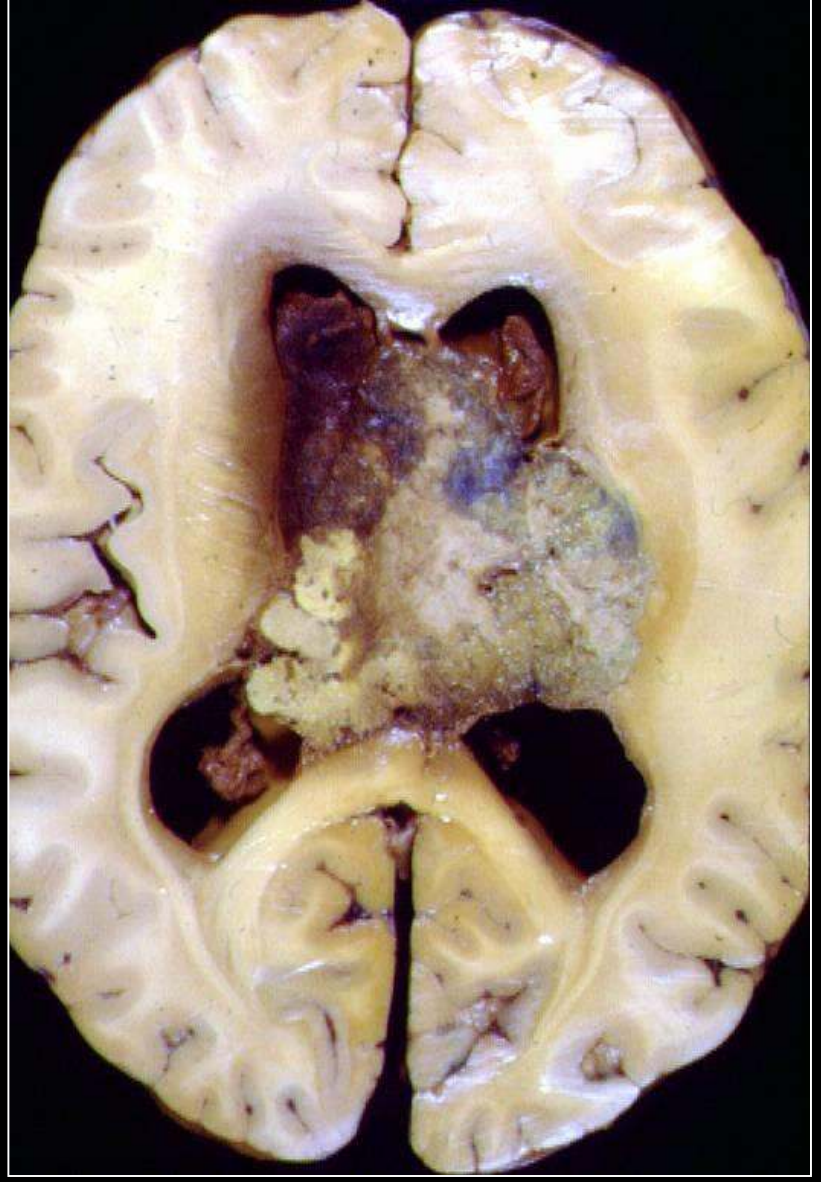
New Hope

- Anti-Angiogenic Agents
- Gene Therapy
- Immunotherapy
- Molecular Pathway Inhibitors

Metastatic Brain Tumor

Metastatic Tumors





25-30% of all intracranial tumours

Lung, breast commonest primary sites

Surgical Removal ??

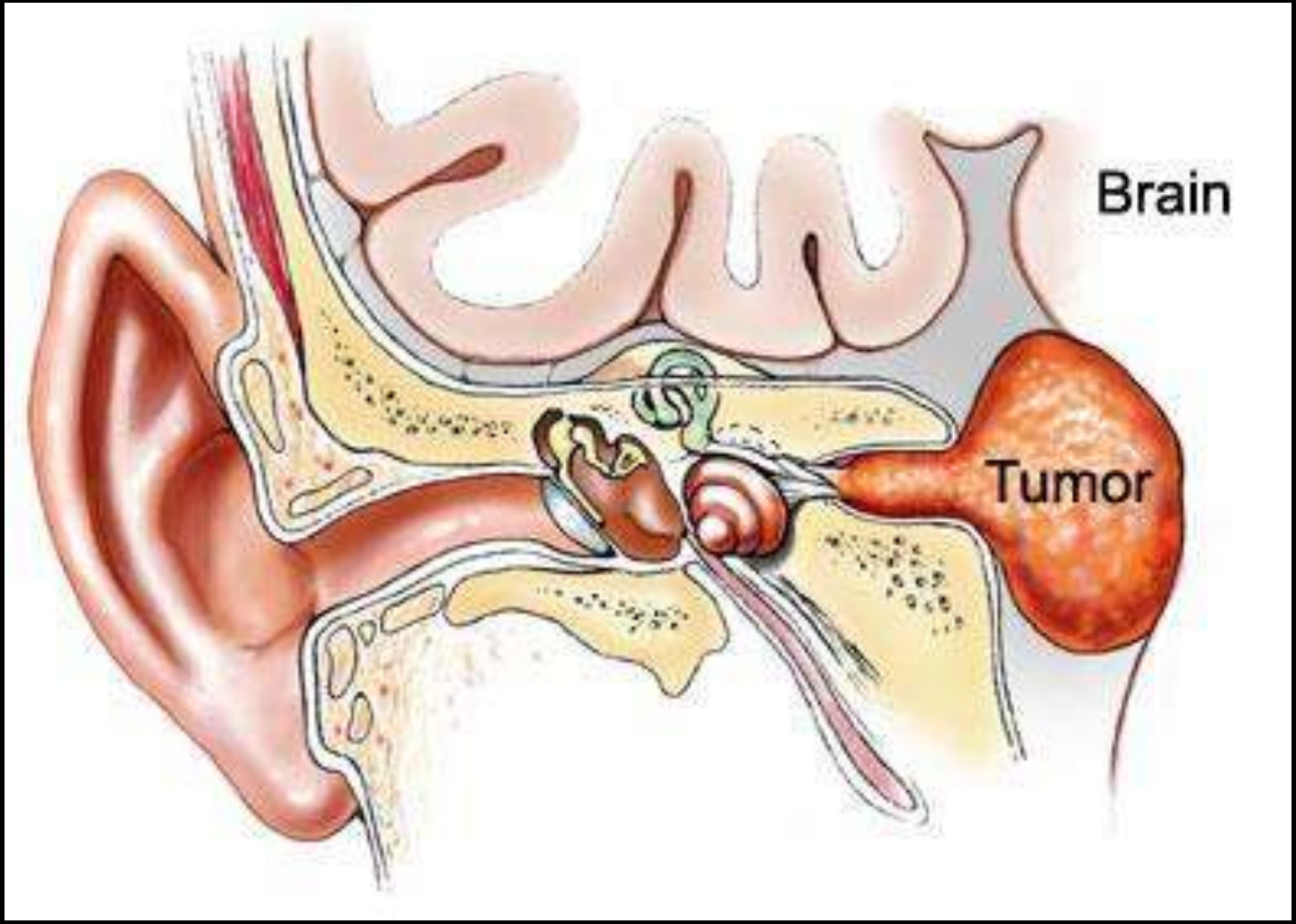
- **Not all px** with brain metastases are candidates for resection
- Consider :
  - The lesion → Number,Location , Size
  - Clinical features of the px
  - Histology of primary tumor

Patient selection

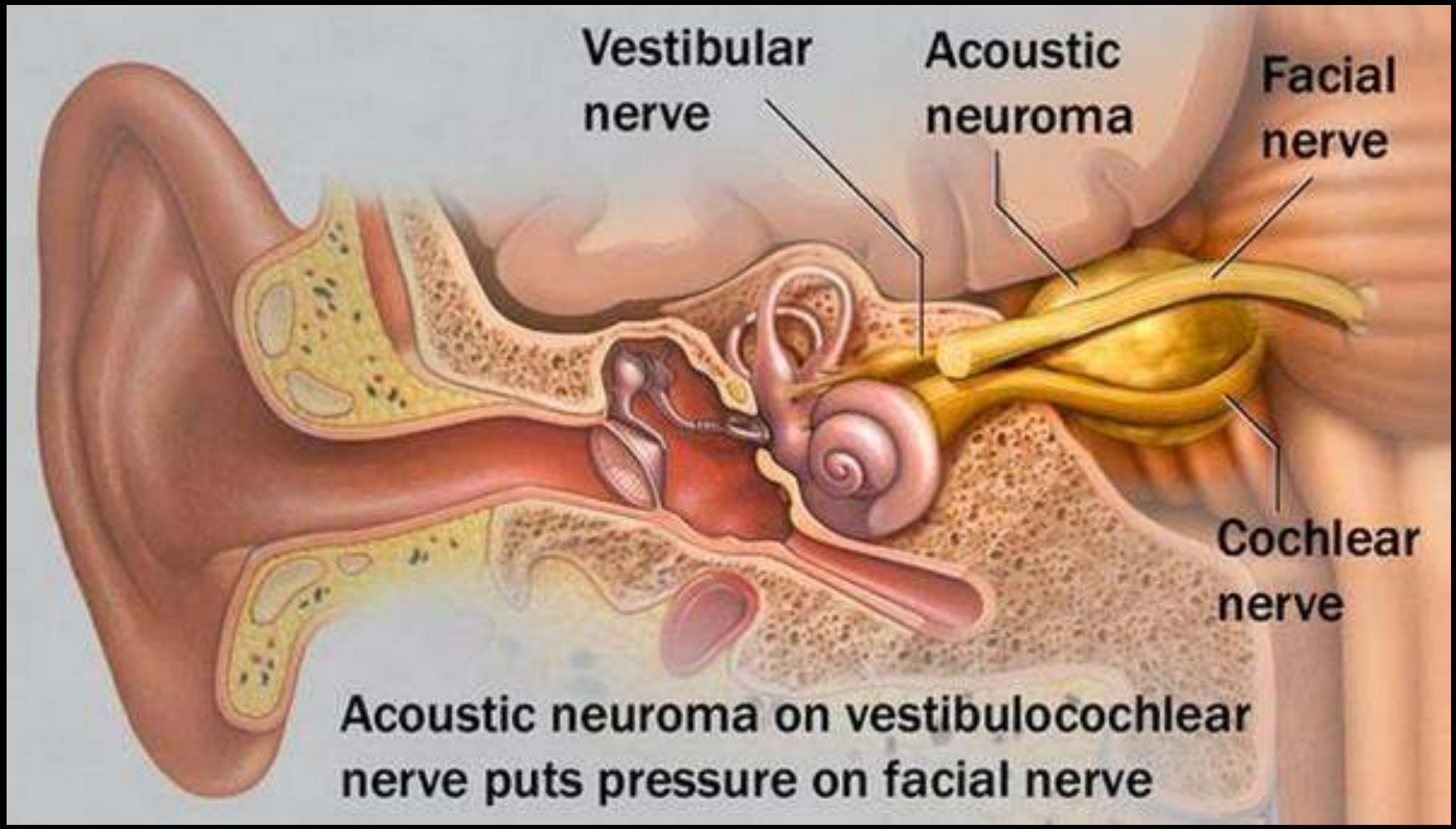
- **STATUS OF SYSTEMIC DISEASE**
  - Control of primary cancer → expected survival > 4 months
  - General medical condition → able to withstand surgery / anesthesia
  - Neurologic status → KPS > 70
- **RESECTABILITY**
  - Accessibility → not brain stem, basal ganglia, thalamus
  - Numbers of lesions → </= 3
- **RADIOSENSITIVITY**

ACOUSTIC SCHWANNOMA

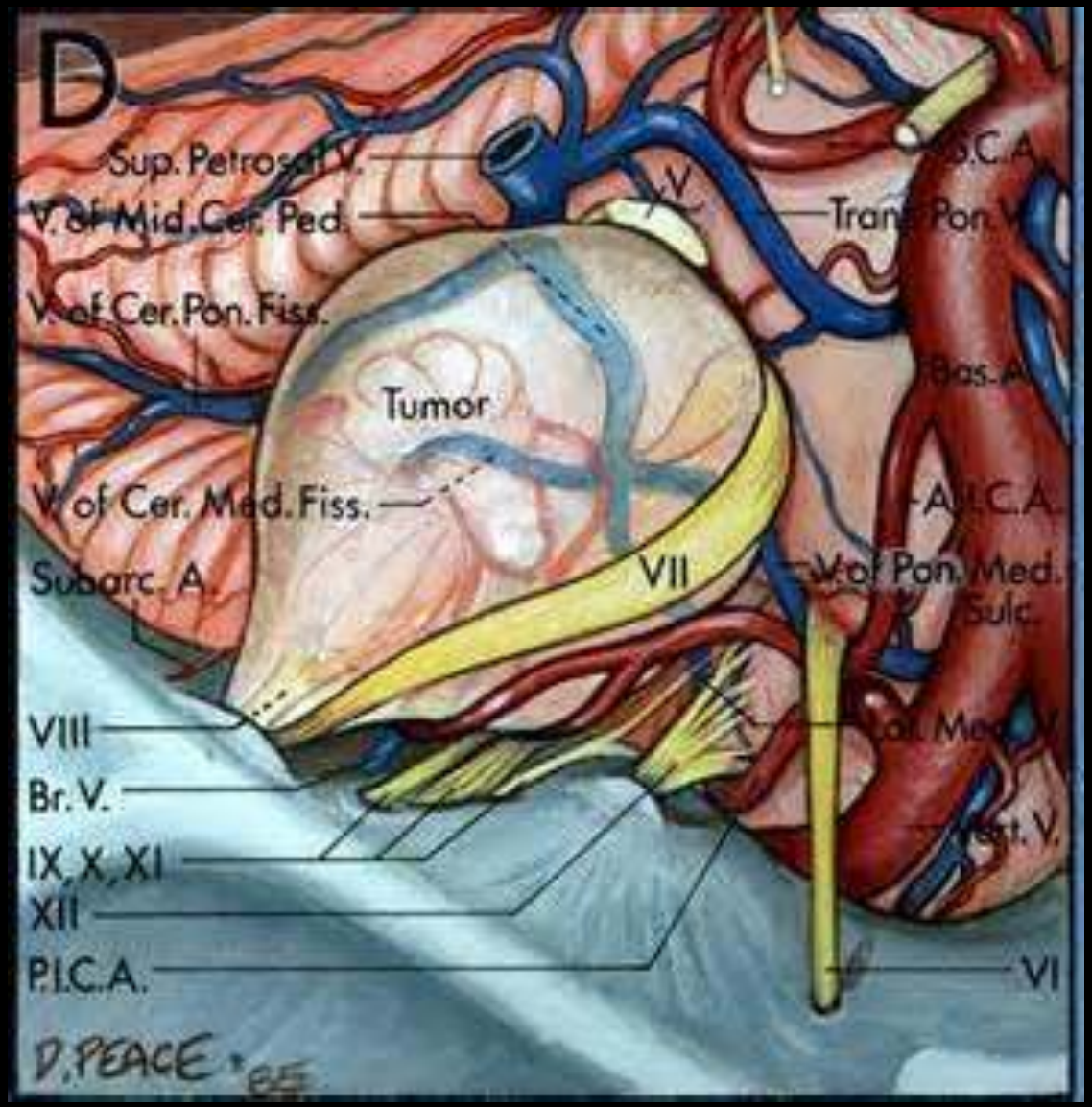
Acoustic schwannoma



Vestibular Schwanoma = Acoustic neurinoma



Vestibular Schwanoma
= Acoustic neurinoma



PROBLEM

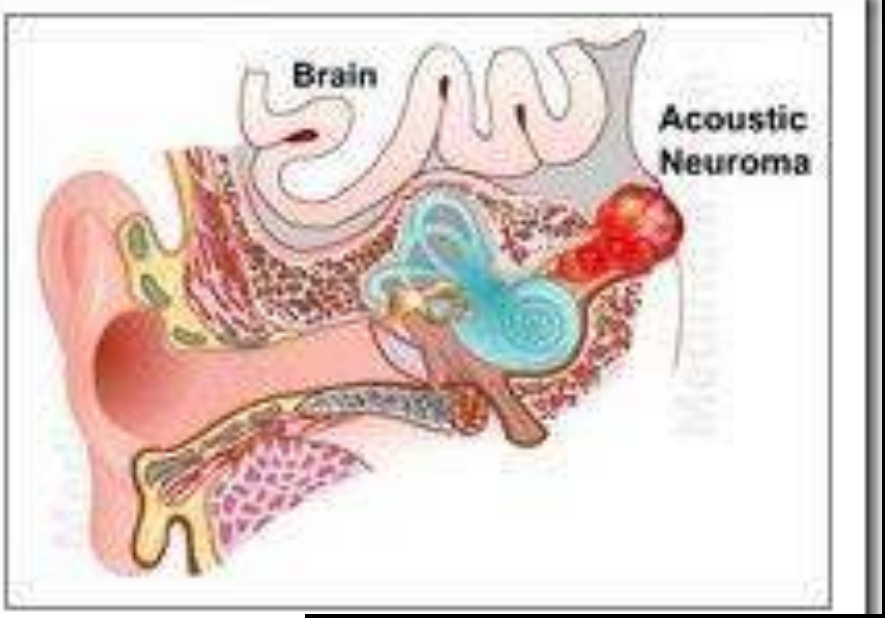
Tumor location

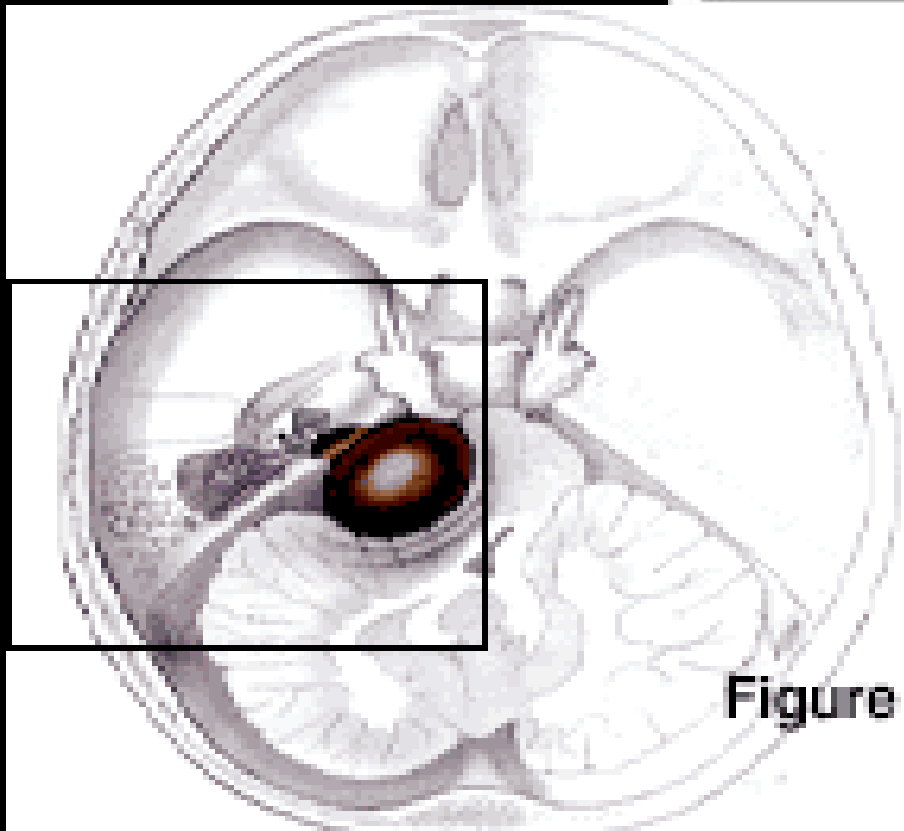
Pressure on Facial Nerve

Injury of facial nerve

(Rhoton, Cranial Anatomy and Surgical Approach

Growth patterns





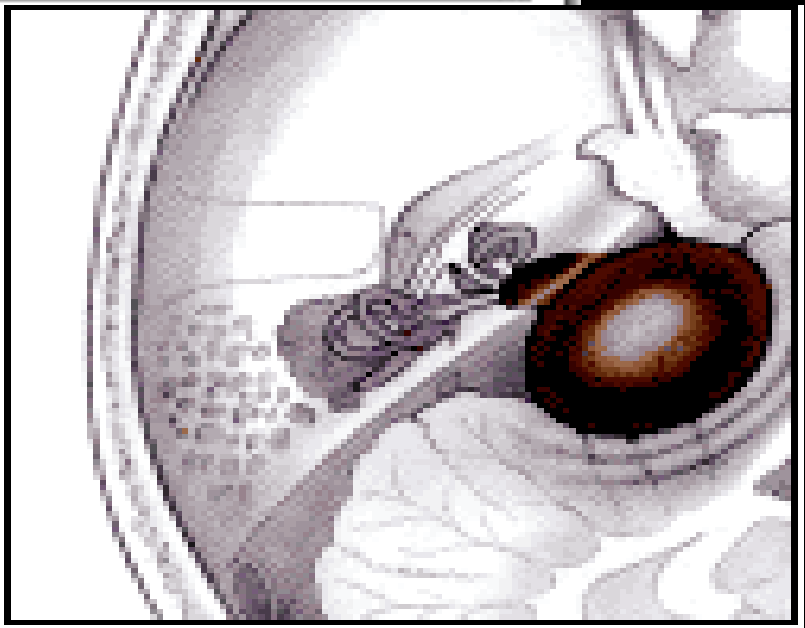
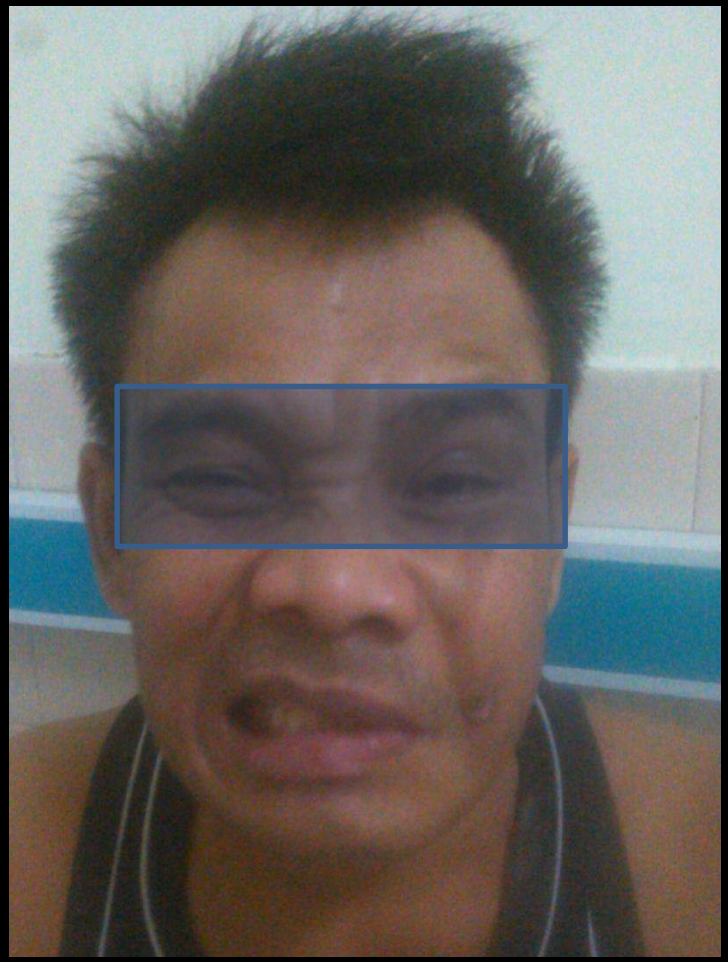


Figure 3. Brainstem compressive stage.

Paresis N. VII



- N.VII memiliki peran yang sangat kritis terhadap fungsi otot wajah
- cedera pada N.VII dapat sangat berat dan memberikan implikasi panjang secara fungsional, emosional, dan sosial sepanjang hidup pasien.

Martin HC, Sethi J, Lang D, Neil-Dwyer G, Lutman ME, Yardley L: Patient-assessed outcomes after excision of acoustic neuroma: postoperative symptoms and quality of life. J Neurosurg 94:211–216, 2001

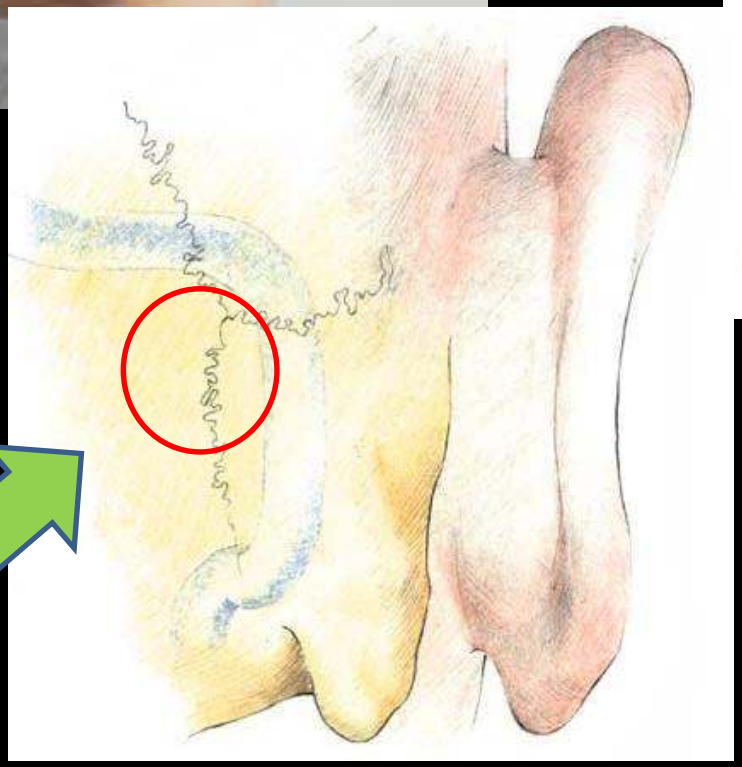
Vestibular Schwannoma

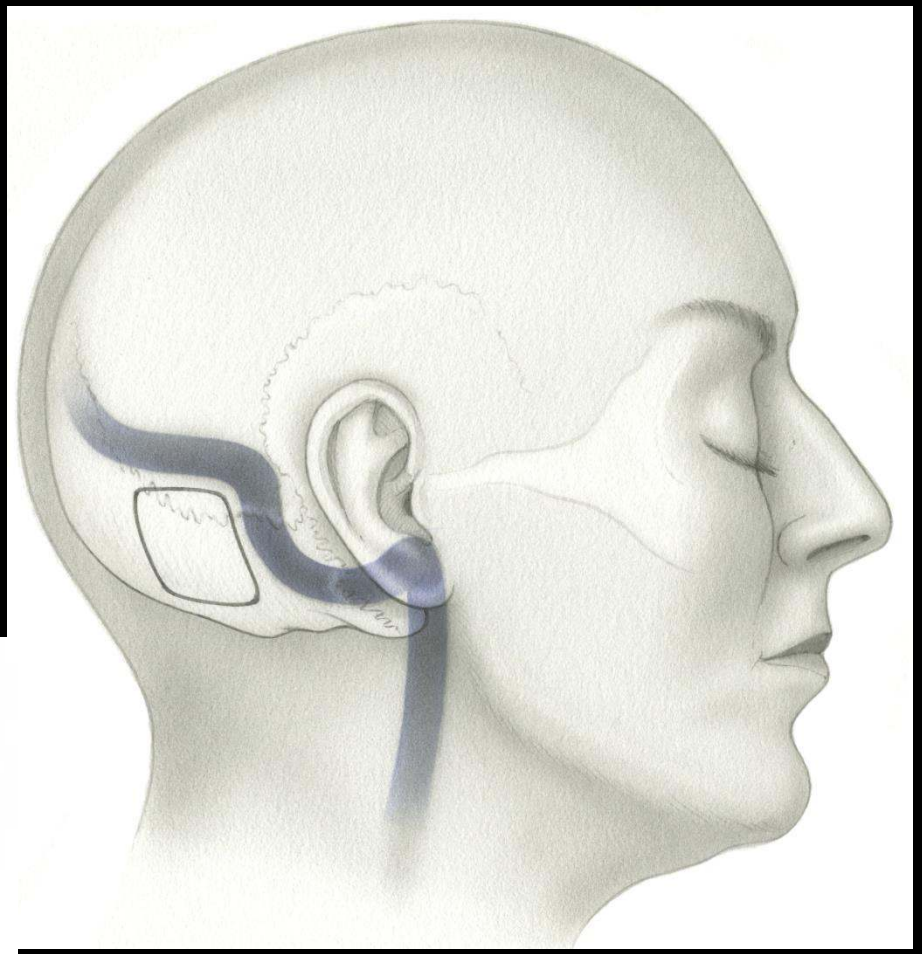
Pre-Op

Post-Op

Vestibular Schwannoma

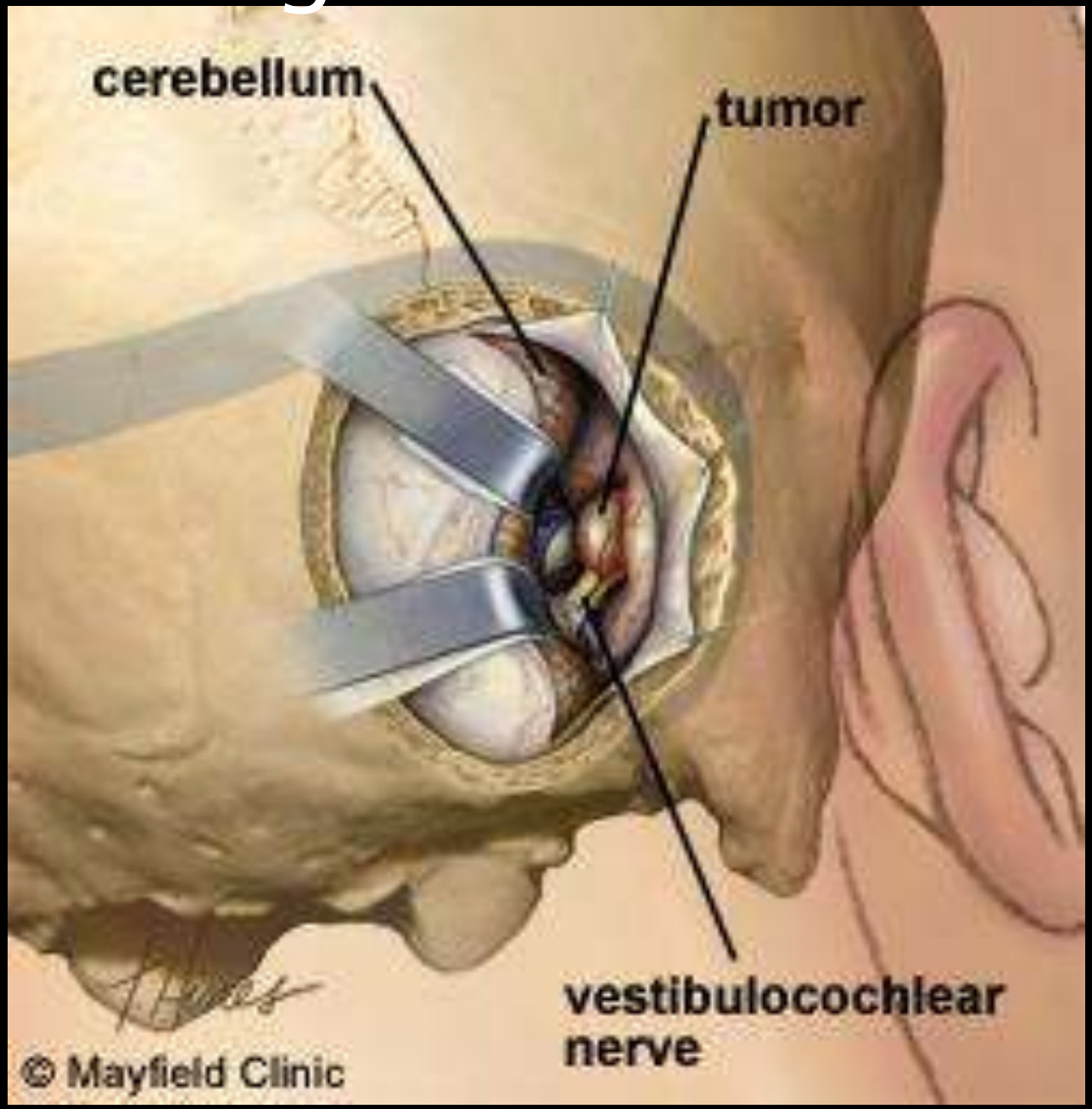
- Benign tumor → origin : vestibular nerve
- **CLINICAL TRIAD** :
  - Hearing loss (insidious & progressive)
  - Tinnitus
  - Dysequilibrium
- Tx option → depent on :
  - TUMOR SIZE
  - Growth
  - Hearing status



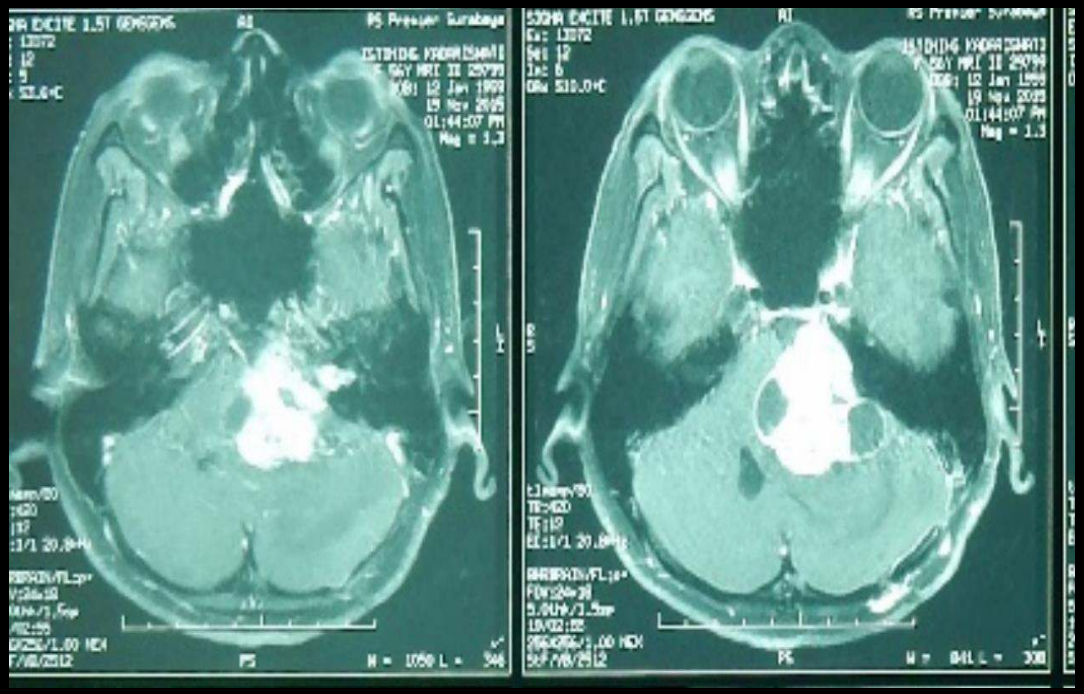


Identification of tranverse and sigmoid sinus

Retro-Sigmoid Craniotomy



Cpa tumor (S) residif



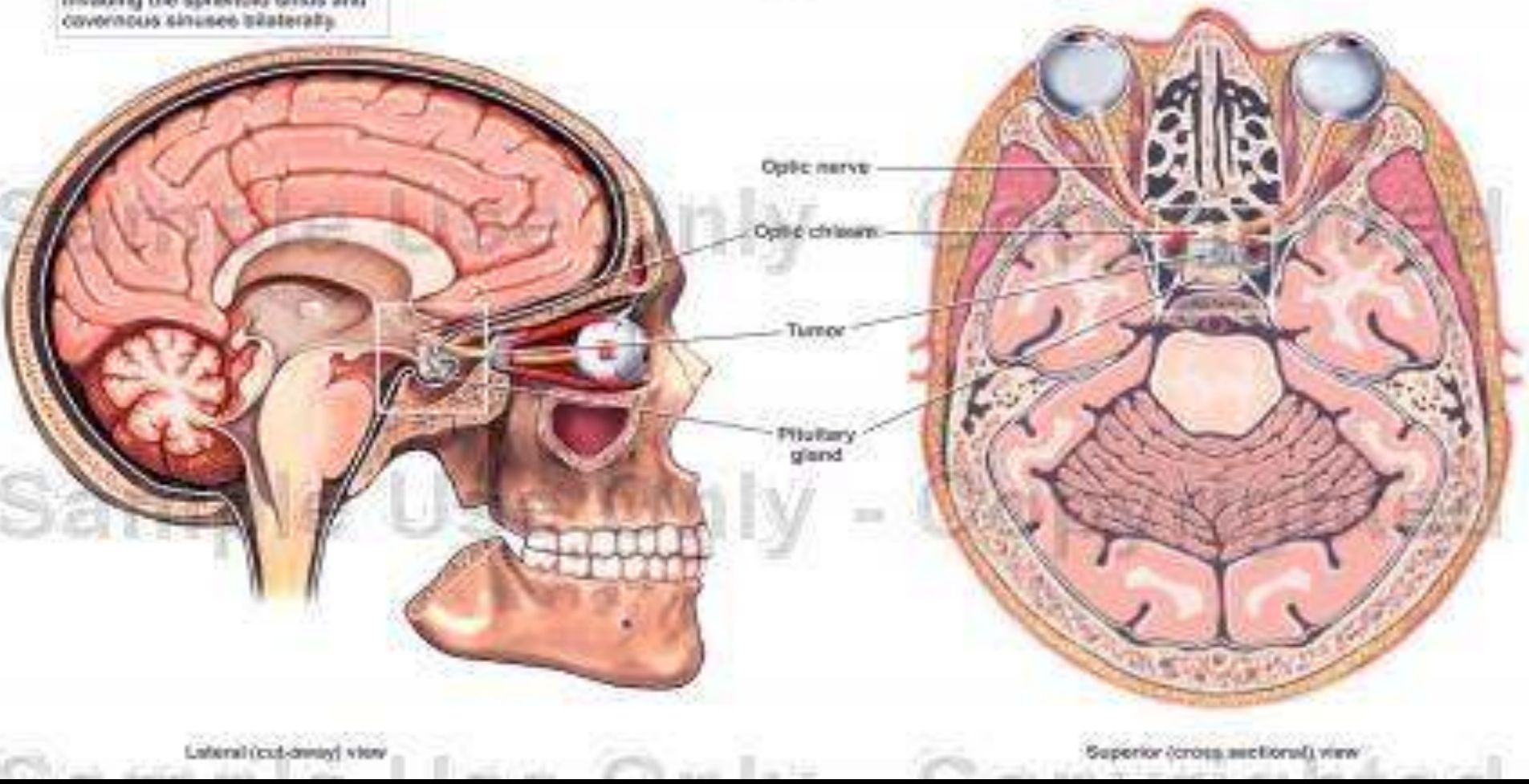
Perempuan 56 th/ gangguan keseimbangan sejak 4 bulan, bicara pelo, telinga kiri berdenging, Riw Operasi tumor Juni 2015/ GCS 15 parese N VII (S), cerebellar sign (+)

Post Op

Pituitary Adenoma

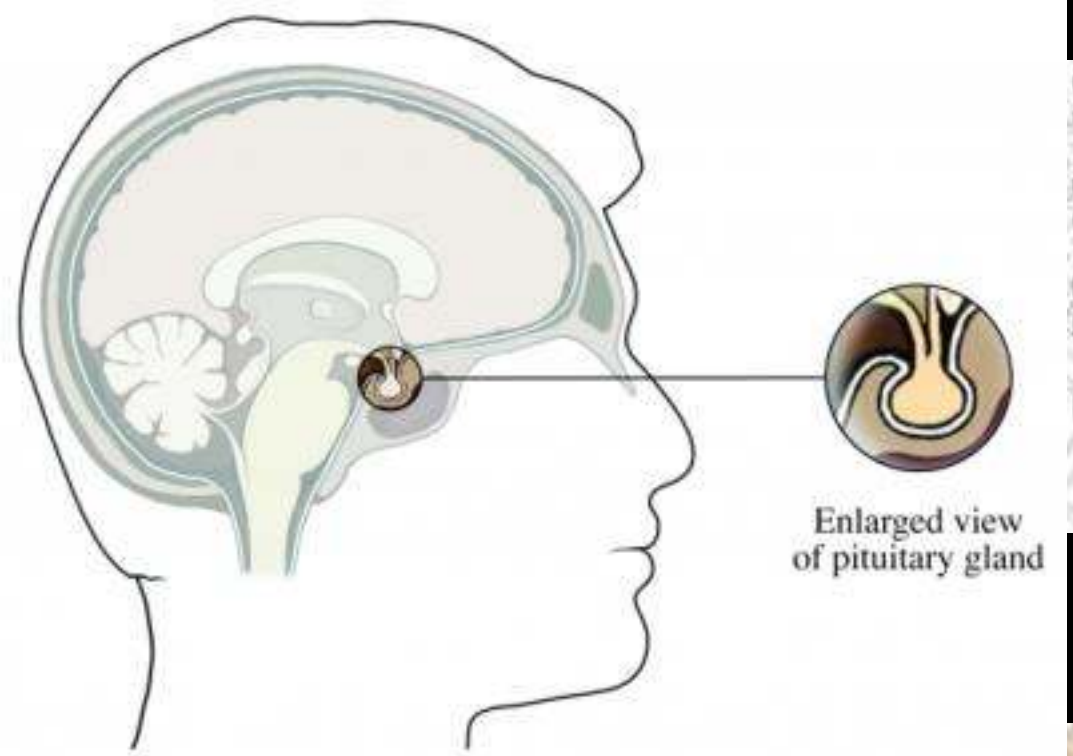
Anatomy of the Brain Before Removal of Pituitary Tumor

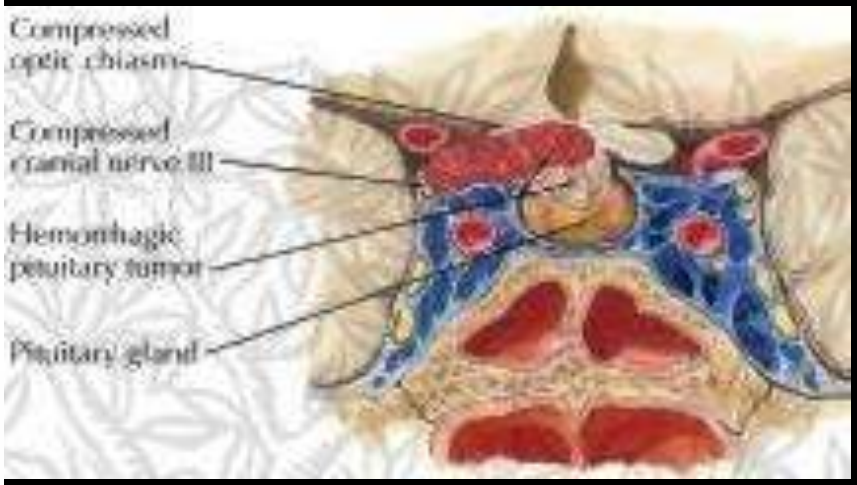
Large pituitary tumor compresses the optic chiasm, as well as invading the sphenoid sinus and cavernous sinuses bilaterally.

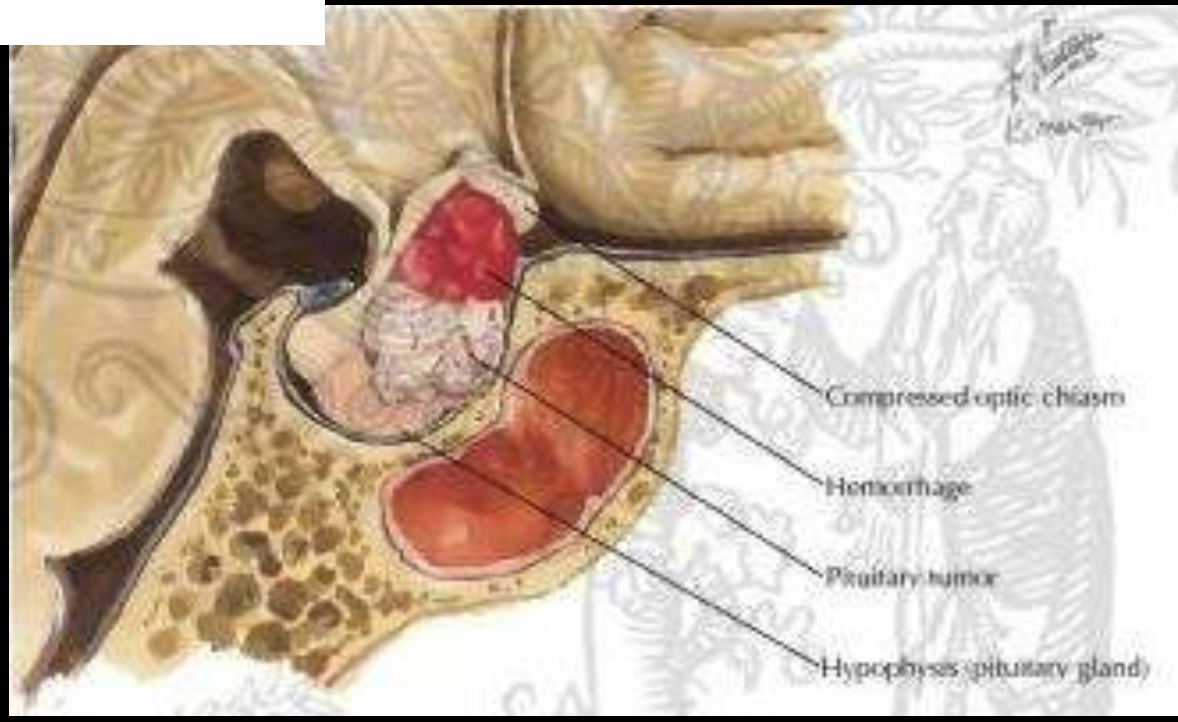


Lateral (cut-away) view

Superior (cross-sectional) view


Enlarged view
of pituitary gland


Compressed
optic chiasm
Compressed
cranial nerve III
Hemorrhagic
pituitary tumor
Pituitary gland


Compressed optic chiasm
Hemorrhage
Pituitary tumor
Hypophyses (pituitary gland)

Epidemiology

- Etiology is unknown
- Not associated with environmental factors
- 10-15% of all primary brain tumors
- 20-25% of pituitary glands at autopsy found to have adenomas
- **70% of adenomas are endocrinogically secreting**

Natural History

- Pituitary adenomas have long natural history
- Vary in size and direction of spread
- Microadenomas < 10 mm – may cause focal bulging
- Macroadenomas > 10 mm – cause problems due to mass effect

Clinical Presentation

- Most common are endocrine abnormalities →
  - hyper-/hyposecretion of ant. pituitary hormones
- Headache
- Vision changes
  - bitemporal hemianopsia and superior temporal defects

Penyempitan lapang pandang

TYPE

- Endocrine-Active Pituitary Adenomas (Functioning Adenoma)
- Non-functioning Adenomas

Endocrine-Active Pituitary Adenomas

- Prolactin → Amenorrhea, galactorrhea, impotence
- Growth hormone → Gigantism and acromegaly
- Corticotropin → Cushing's disease, Nelson's syndrome post adrenalectomy
- TSH → Hyperthyroidism

Non-functioning Adenomas

- 25-30 % of patients do not have classical hypersecretory syndromes
- **May grow to a large size before they are detected**
- Present due to mass effect :
  - **Visual deficits**
  - **Headache**
  - Hormone deficiency

Evaluation

- MRI
- **Visual field assessment**
- Endocrine evaluation
  - Tests of normal gonadal, thyroid, and adrenal function
  - Radioimmunoassays – for hormone levels

General Management

- Pituitary adenoma management is complex and is dictated by
  - size,
  - Symptoms,
  - character of tumor
- Treatment options require multiple modalities

General Management

- Multidisciplinary approach
- Goals:
  - Define tumor extent
  - Evaluate hormone activity
  - Remove tumor mass
  - Control hypersecretion
  - Correct endocrine deficiencies

Management of Pituitary Adenoma

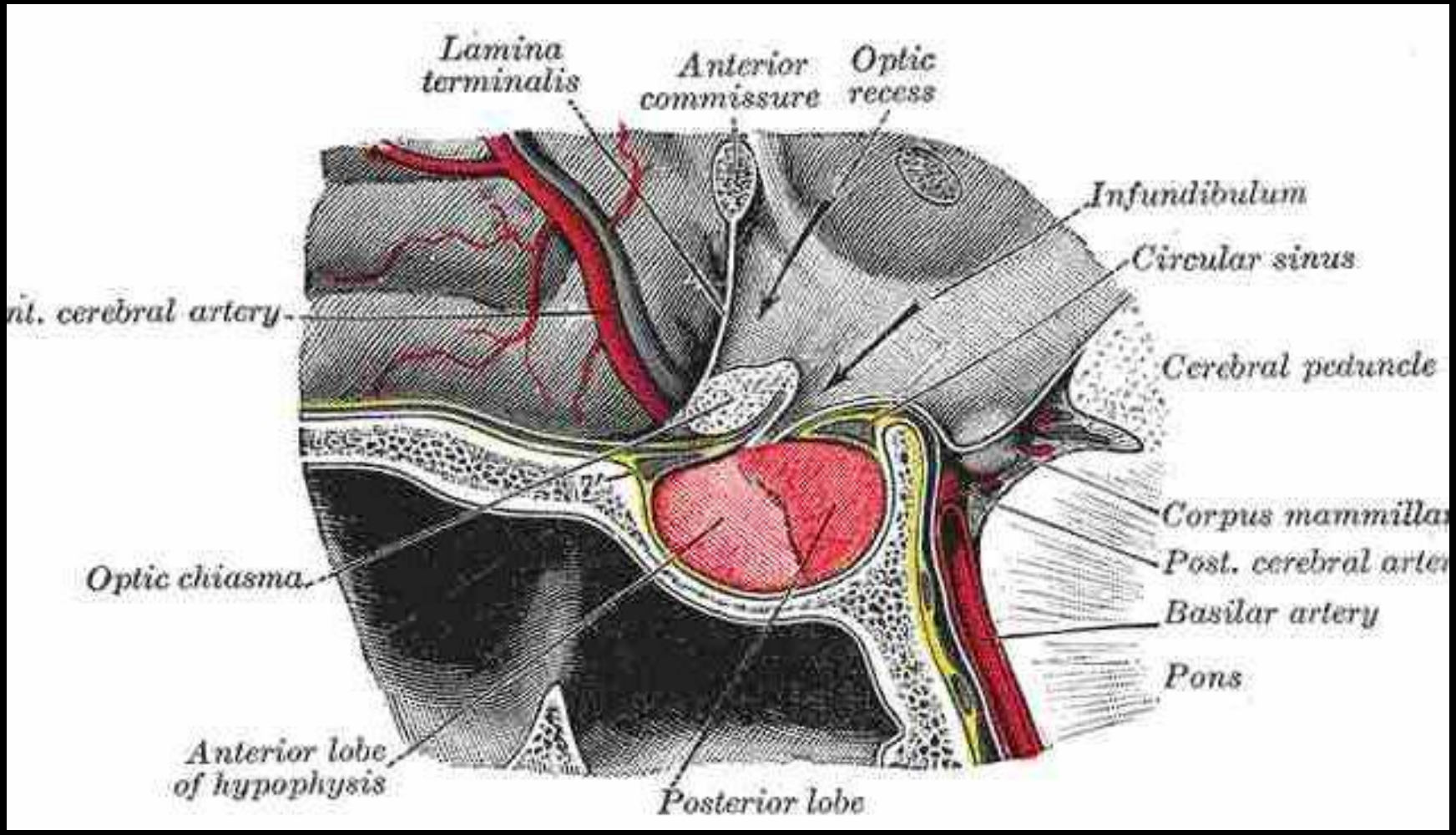
- Observation
- Pharmacotherapy
- Surgery
- Radiation Therapy (EBRT, SRS)

Indications for Surgery

- Surgery is the **first-line treatment** of symptomatic pituitary adenomas.
- Useful when medical or radiotherapy fails
- Surgery provides prompt relief from excess hormone secretion and mass effect.
- Indicated in **pituitary apoplexy** with compressive symptoms

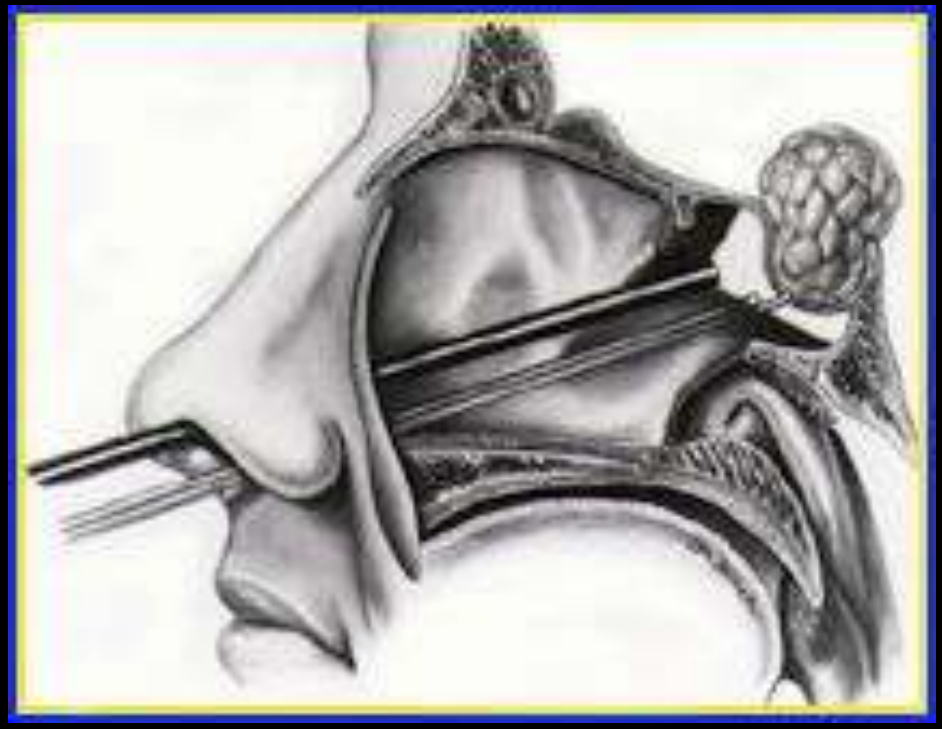
Pituitary apoplexy

- Sudden expansion of Pituitary adenoma (HEMORRHAGE or NECROSIS)
- Paroxysmal HEADACHE with endocrine deficiency
- Visual disturbance (usually opthalmoplegia or visual loss)
- Increased ICP, Hypothalamic involvement, hydrocephalus
- Tx :
  - Immediate tx of pituitary function & endocrine evaluation
  - Decompression (Transphenoidal) → within 7 days

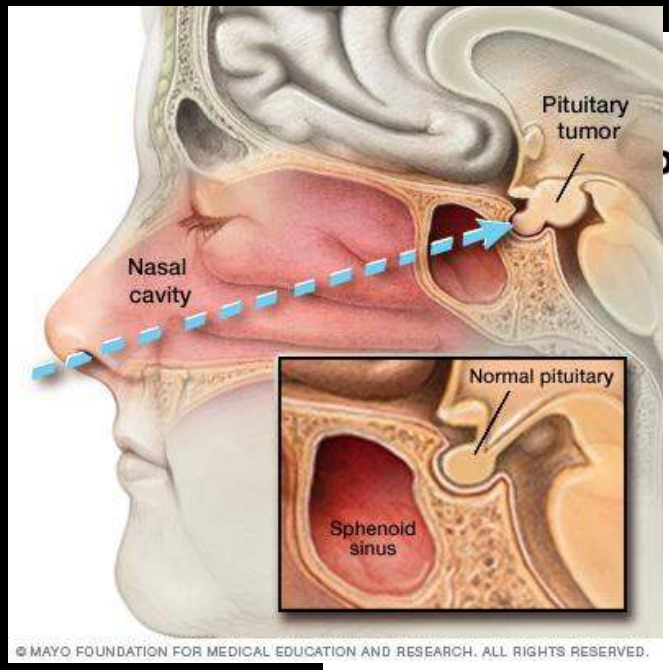

Lamina terminalis
Anterior commissure
Optic recess
Infundibulum
Circular sinus
nt. cerebral artery
Cerebral peduncle
Corpus mammillar
Post. cerebral arter
Optic chiasma
Basilar artery
Pons
Anterior lobe of hypophysis
Posterior lobe

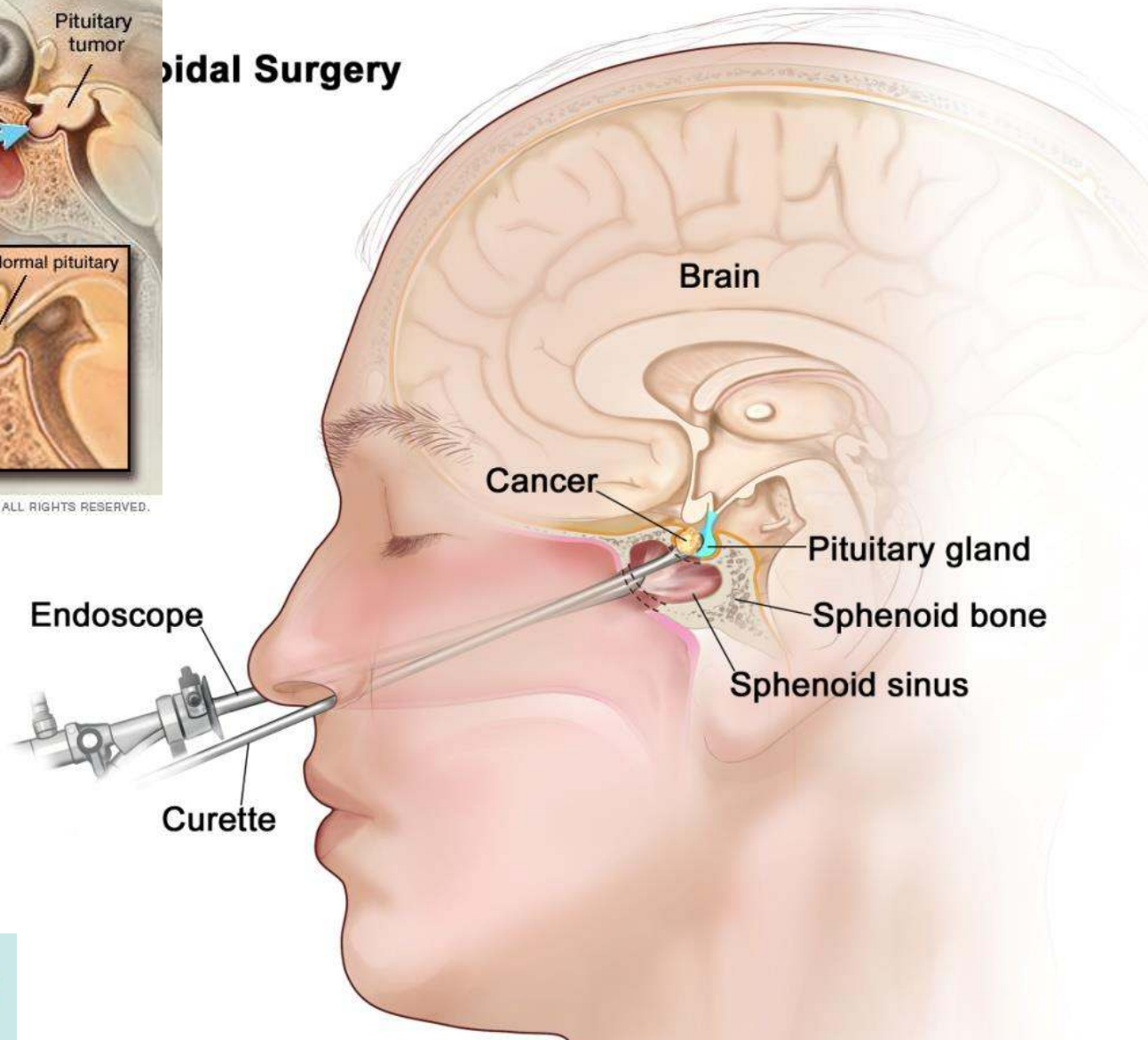
Pituitary Surgery

- Transsphenoidal approach: used for 95% of pituitary tumors
- Endonasal submucosal transseptal approach
- Septal Pushover/Direct Sphenoidotomy
- Endoscopic approach

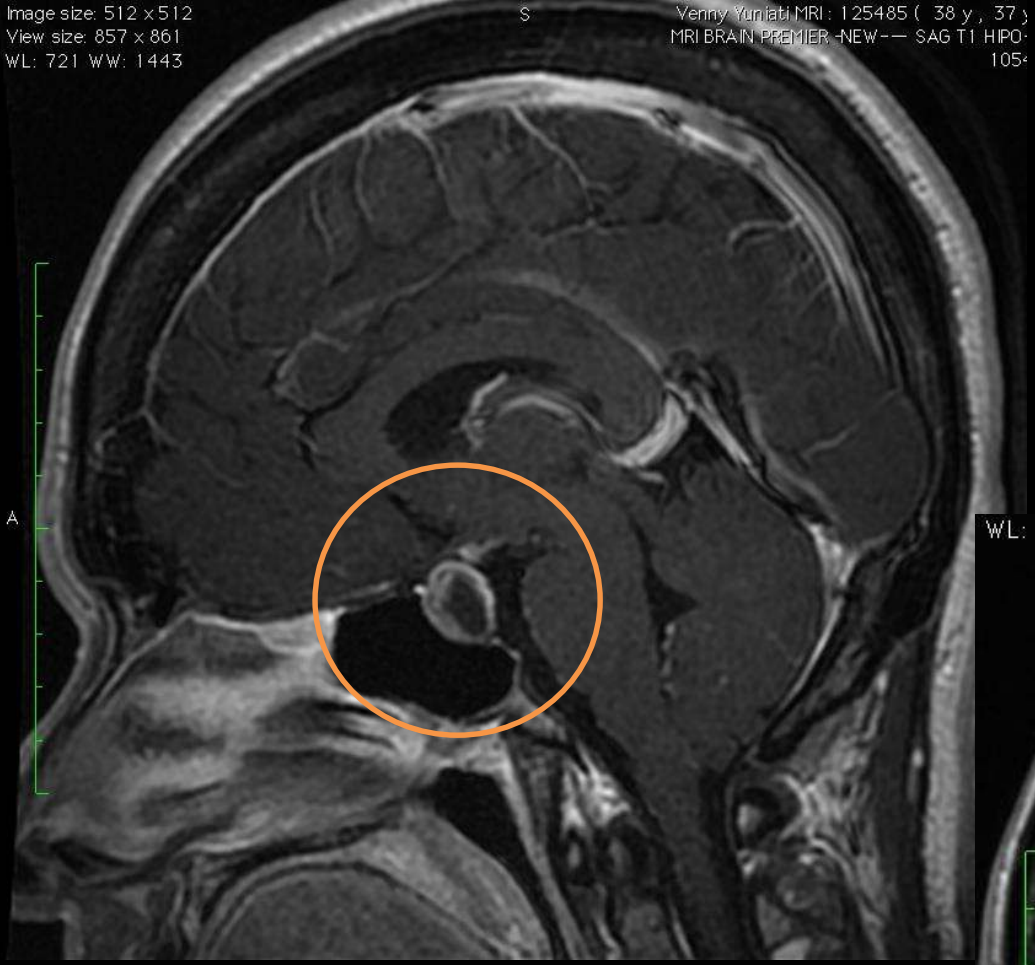


Endoskopi neurosurgery

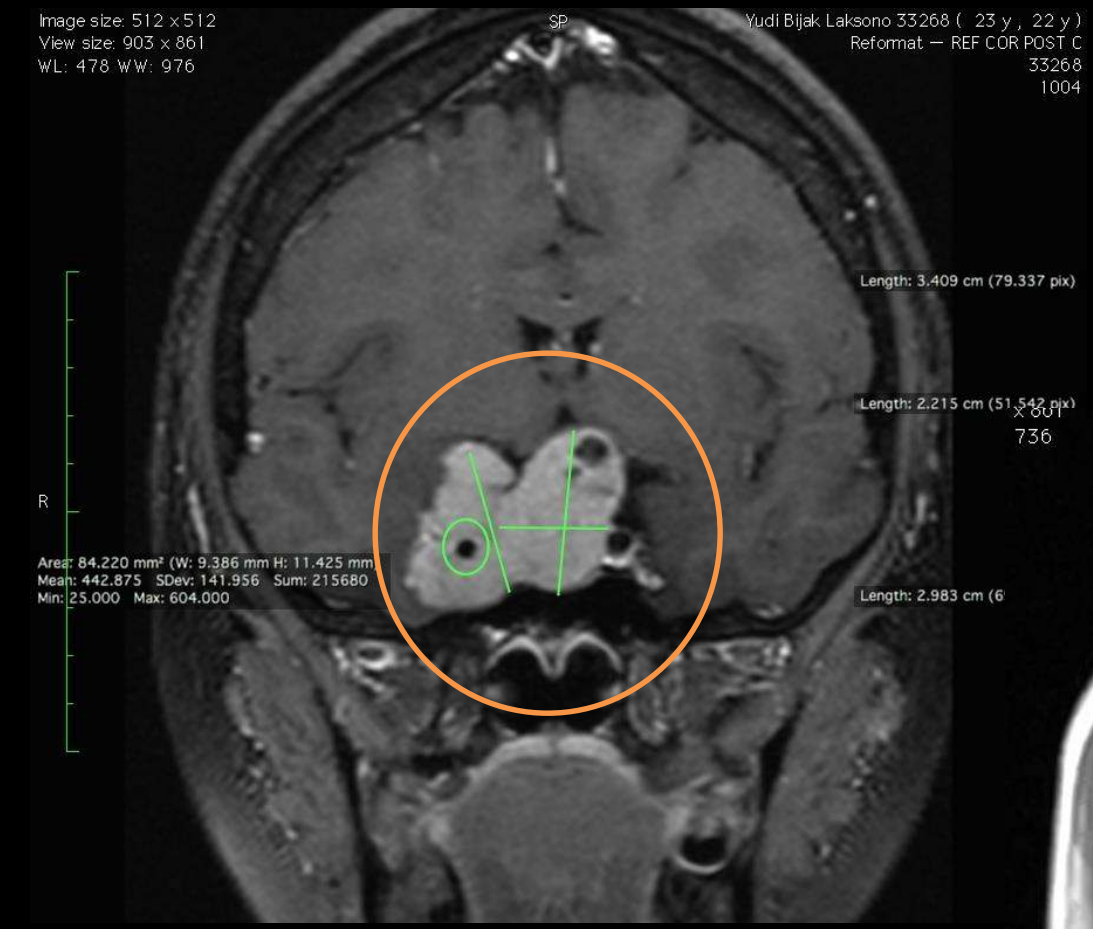




BRAIN TUMOR & PITUITARY DISORDER CENTER



Wanita, 34 tahun,
gangguan menstruasi,
tangan dan kaki makin membesar
Peningkatan Hormon
Pertumbuhan

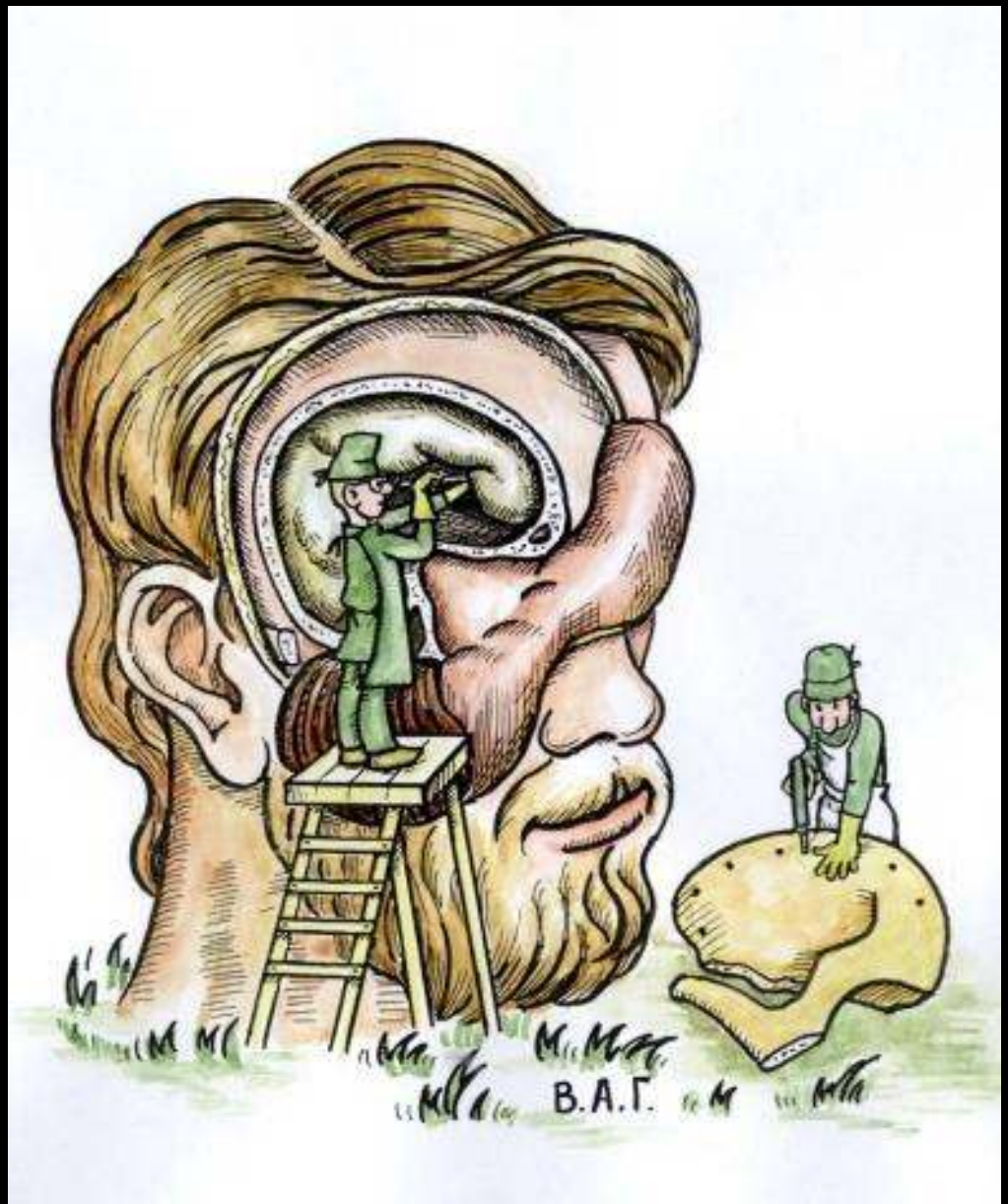


Pria, 23 tahun,
Gangguan Penglihatan (lapang pandang)
Gangguan ereksi
Peningkatan Hormon PROLAKTIN

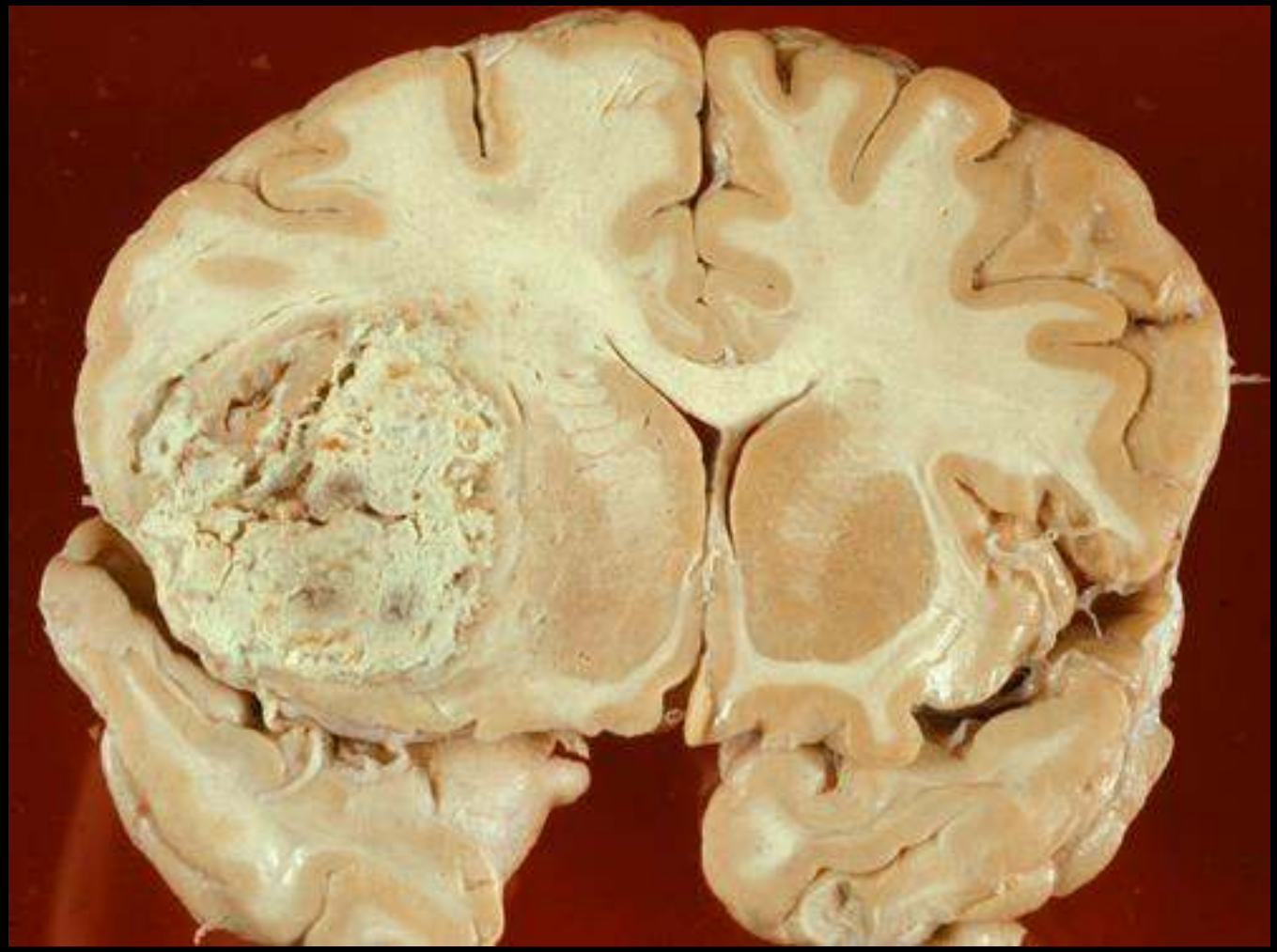
Radiation Therapy

- Reserved for patients with larger tumors and/or persistent hormonal hyperfunction despite surgical intervention
  - Conventional radiotherapy (EBRT)
  - Stereotactic Radio Surgery (SRS)
  - Gamma knife radiosurgery

Thank You



ASTROCYTOMA

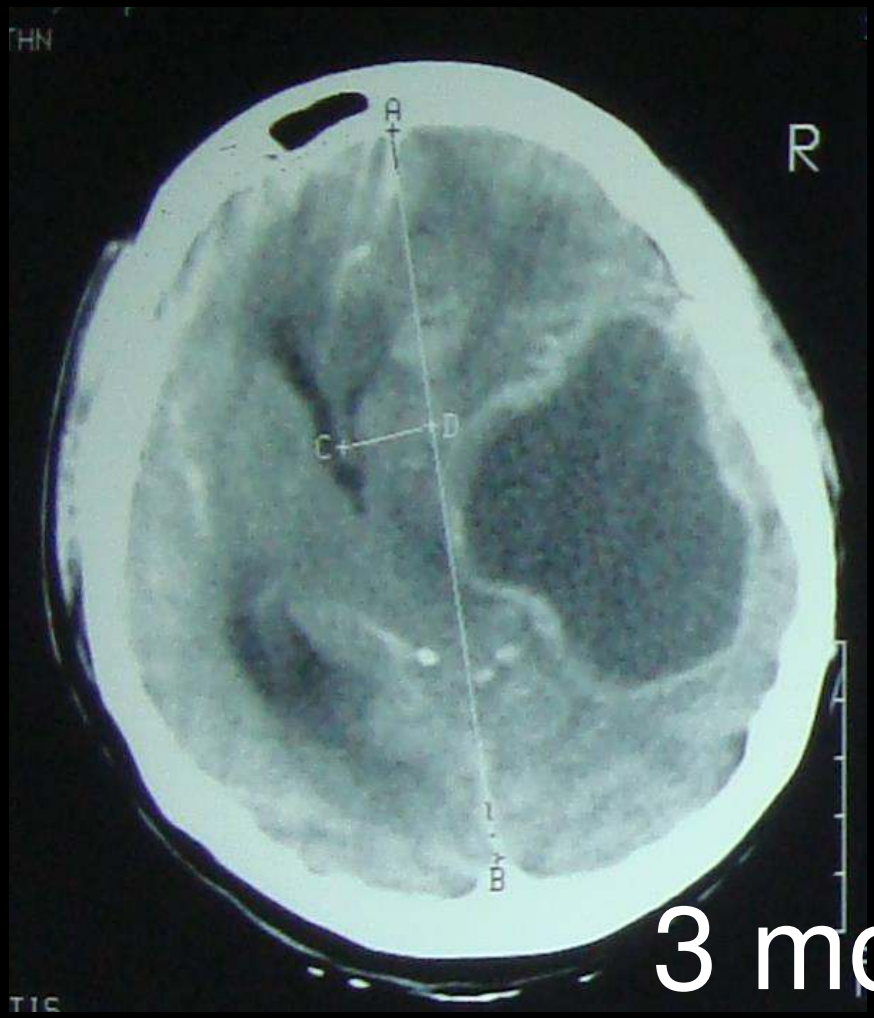


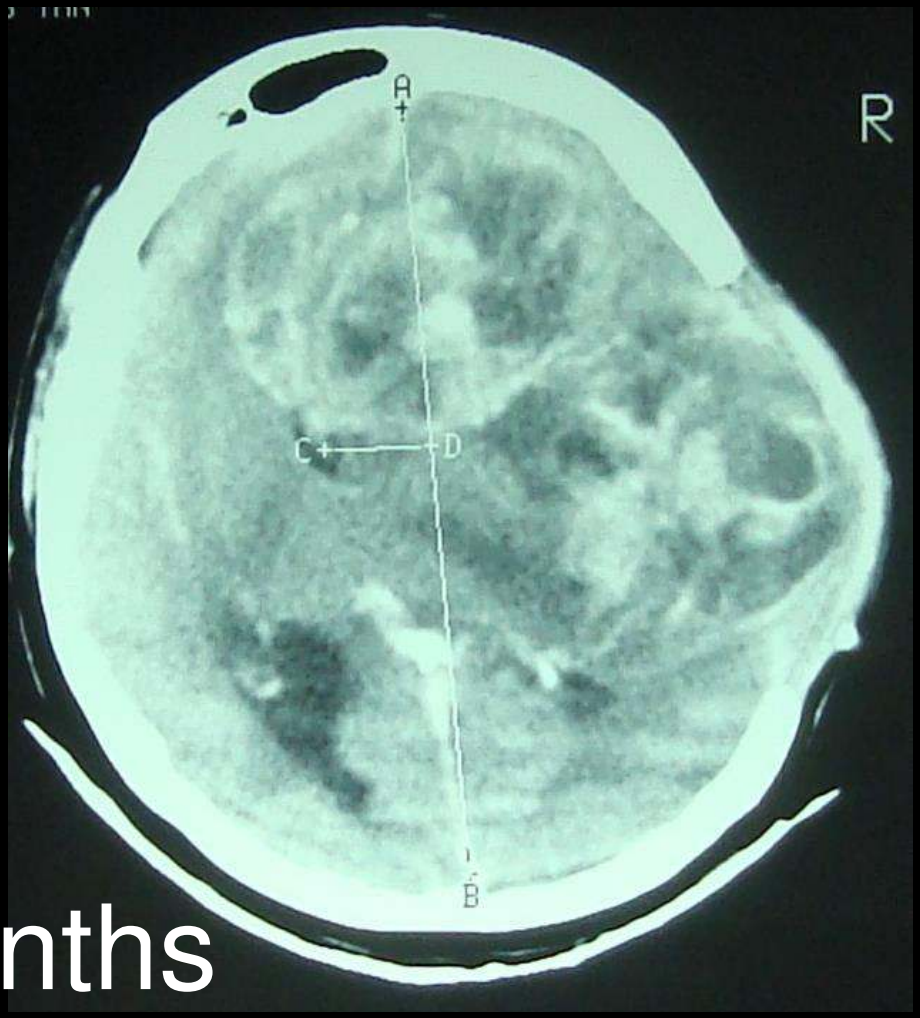
WHO Classification

- Grade I (Pilocystic Astrocytoma)
  - Most frequent brain tumors in children
- Grade II (low grade Astrocytoma)
  - 25% of glioma & infiltrative
- Grade III (anaplastic Astrocytoma)
  - Highly malignant , progress to GBM
- Grade IV (glioblatomamultiforme)
  - Highly malignant, poor prognosis
  - rapid spread to other region of the brain

Low grade

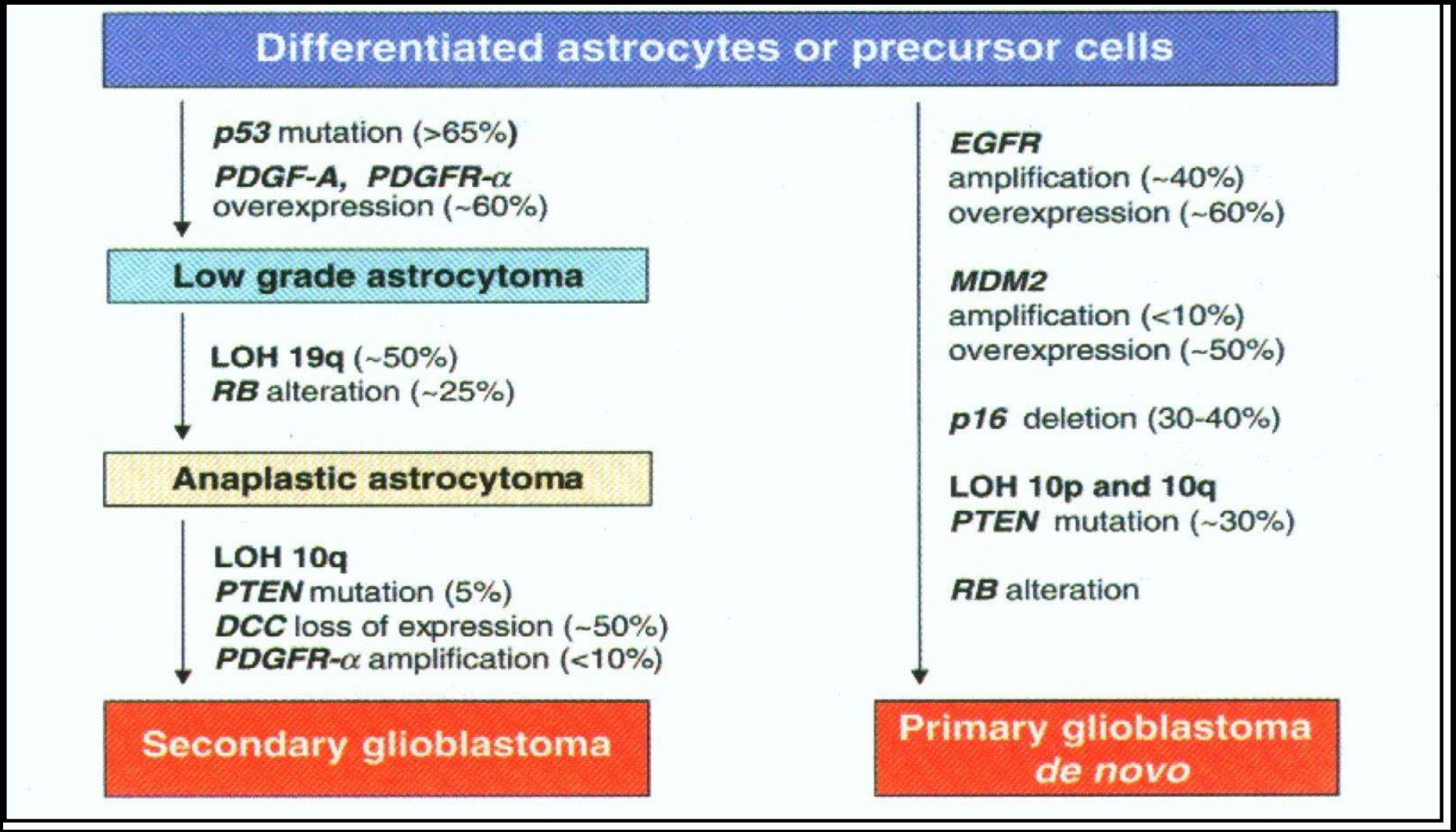
High grade



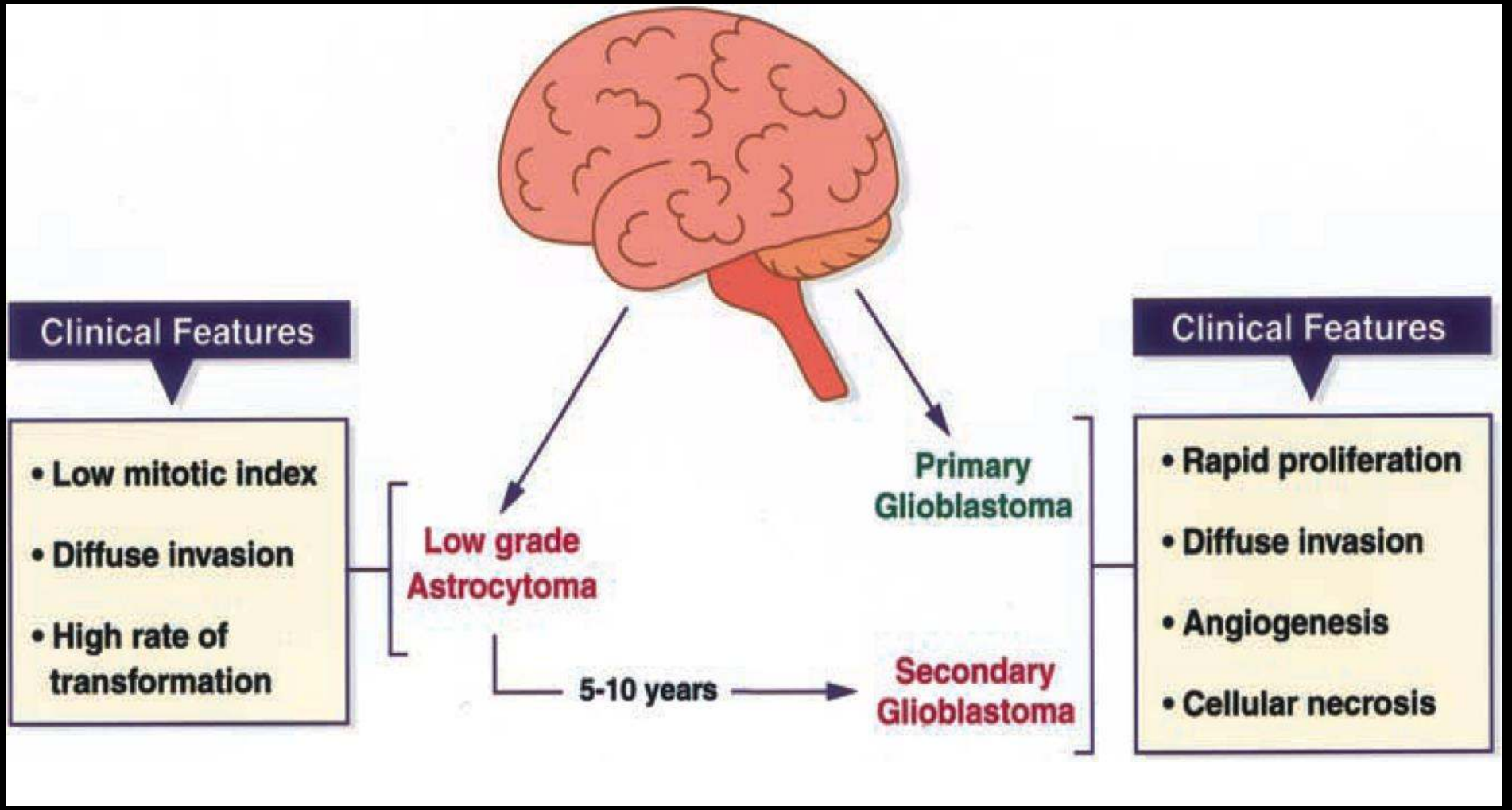


3 months

F/ 36 yo



Continuously mutating Brain Tumor



Long term follow up

Treatment

- MULTIDISCIPLINARY
- OPTIONS :
  - Surgery
  - Radiation
  - Chemotherapy

Major Prognostic Factors

- Age
- Karnofsky Performance Score
- Histological type
  - (oligodendroglial, mixed or astrocytic)
- Tumour grade
  - (WHO grade III or IV)

OTHER prognostic factors :

- **The extent of resection**
- The location and **volume of the tumour.**

Tx High grade glioma

- **Surgery is the initial recommended approach** in suspected high grade gliomas,
- **Goal of surgery**
  - debulking,
  - clinical improvement
  - pathologic diagnosis
  - SET UP OTHER THERAPIES

Resection vs Biopsy

- **Vuorinen et al (2003):**

  "survival advantage for resection over biopsy"

- **Nomiya et al :**

  retrospectively analyzed

  the impact of the extent of resection exclusively in 170 patients with Anaplastic Astrocytoma → better survival.

Table 3: Evidence table for studies referred to in the systematic review for surgery

Authors [ref.] (Date)	Study Type	Tumour grade	Treatment allocation	Number of patients	Median Survival (Months)	P-value
Vuorinen et al. [25] (2003)	RCT	III and IV	Resection ± RT [1] Biopsy ± RT	10 13	5.7 2.8	.0346
Lacroix et al [19] (2001)	Retrospective	IV	≥ 98% resection < 98% resection	197 219	13 8.8	0.0001
Shinoda et al [26] (2001)	Retrospective	IV	GTR chemo ± RT < GTR chemo ± RT	36 46	13 9.0	0.0002
Kreth et al. [5] (1999)	Retrospective	IV	Resection ± RT Biopsy ± RT	126 99	8.8 7.8	0.09
Mohan et al. [32] (1998)	Retrospective	IV	Biopsy only Biopsy and radiation STR [2] and radiation GTR [3] and radiation	25 28 42 07	1.2 5.1 7.2 17.3	0.0001
Kowalczuk et al. [20] (1997)	Retrospective	III and IV	GTR chemo ± RT STR chemo ± RT Biopsy chemo ± RT	29 33 13	27.6 34 13	0.039
Kiwit et al [27] (1996)	Please complete	IV	GTR Biopsy	40 40	10 6	<0.05
Slotman et al [24] (1996)	Prospective	IV	>75% resection ± RT <75% resection ± RT	20 8	10 7	<0.05
Quigly et al [18] (1995)	Retrospective	III and IV	GTR STR Biopsy	9 31 23	27 11 10	<0.05

Table 3 (contd.): Evidence table for studies referred to in the systematic review for surgery

Authors (Date)	Study Type	Tumour grade	Treatment allocation	Number of patients	Median Survival (Months)	P-value
Nitta et al.[28] (1995)	Prospective	IV	GTR chemo ± RT STR chemo ± RT PR[4] chemo ± RT	14 27 27	53 14 14	<0.01
Kelly et al.[21] (1994)	Prospective	IV	SVR[5] ± RT SB[6] ± RT	40 88	6.3[7] 3.6	0.008
Simpson et al.[33] (1992)	Prospective	IV	Partial resection ± chemo ± RT Biopsy + chemo ± RT Total resection ± chemo ± RT	413 107 125	10.4 6.6 11.3	<0.001[8] <0.0001[9]
Laws et al[37] (2003)	Prospective	IV III	Biopsy Craniotomy Biopsy Craniotomy	84 329 41 106	4.9 10.57 12.16 20.3	<0.0001 <0.0001
Stummer et al[35] (2006)	RCT	High grade gliomas	Surgery with 5-aminolevulinic acid Surgery with white light	139 131	5.1[10] 3.6	<0.0003
Stummer et al[34] (2008)	RCT	IV	Partial resection Complete resection	121 122	11.8 16.9	<0.0001

Surgery

- Surgical resection as the main treatment for
  - alleviation of symptoms and
  - prolongation of life
- **Most studies report a survival advantage for resection over biopsy**
  - Alberta Cancer Board, Clinical Practical Guideline, Management of Glioblastoma Multiforme, 2009
- **Recommendation:**
  gross total resection, **when safe**,
  in high grade gliomas (WHO grade III and IV).

Adjuvant Chemo- Radiation Tx

"the standard of care following surgery"

1. surgery
2. followed by adjuvant **combined Temozolomide-based chemotherapy and radiation →** **"Concomitant Treatment"**
3. followed by adjuvant **Temozolomide for a total of six to 12 cycles.**

Radiation Tx

- External beam radiation therapy will be given in standard fractionation to a maximum total dose of 59.4 - 60 Gy using 3D conformal planning techniques.
  - **TUMOR PLUS 1 – 2 CM FIELD**
- The volume treated should be partial brain irradiation and not whole brain irradiation
- No evidence to recommend a total dose >60 Gy in standard fractionation

Elderly Px

- Elderly patients (≥60 years old)
  with a poor performance status (KPS ≤70), → adjuvant radiation tx alone,
  with or without tissue diagnosis

- Radiation Tx→ abbreviated to 40 Gy in 15 fractions

cases

1. Male, 56 y.o, concomitant dose 160 mg for 45 days, adjuvant dose 380 mg (6 cycles).
2. Male, 35 y.o, concomitant dose 160 mg for 45 days, adjuvant dose 380 mg (6 cycles).
3. Male, 35 y.o, concomitant dose 140 mg for 45 days, adjuvant dose 320 mg (6 cycles).
4. Female, 48 y.o, concomitant dose 120 mg for 45 days, adjuvant dose 280 mg (6 cycles).
5. Male, 55 y.o, concomitant dose 160 mg for 45 days, adjuvant dose 380 mg (6 cycles).
6. Male, 28 y.o, concomitant dose 140 mg for 45 days, adjuvant dose 360 mg (5^{th} cycle).
7. Male, 45 y.o, concomitant dose 160 mg for 45 days, adjuvant dose 360 mg (4rd cycles).
8. Male, 20 y.o, concomitant dose 160 mg for 45 days, adjuvant dose 400 mg (3^{rd} cycle).
9. Male, 10 y.o, adjuvant dose 220 mg (6 cycles).
10. Male, 54 y.o, adjuvant dose 280 mg (3^{rd} cycle).
11. Female, 18 y.o, adjuvant dose 340 mg (1^{st} cycle).

Result

- No major side effect that need medical tx
- Outcome : → follow up

Outcome

- Need long term follow up
- Future : Indonesia Brain Tumor Registry

THANK YOU