Introduction

डा० प्रकाश खेतान

MS (Gen. Surg.), DNB, Mch (Neuro), KGMC (Lucknow)

Neurosurgeon

मस्तिष्क, रीढ़, नस रोग विशेषज्ञ

Ex. Consultant Neurosurgeon Fortis Hospital, New Delhi

Fortis

- Recipient of **"Guinness World Record"** for successfully taking out **"296 Hydatid Cyst"** from Brain
- Recipient **"Limca World Record"** 2012
- **Brand Ambassador** Allahabad Museum
- Author **'Review of Neurosurgery'**
- Specialization in Endoscopic and Micro Neurosurgery

The role of highly selective Acupressure therapy in the management of high risk craniovertebral junction and brain stem tumour

Journal of Neuro-Oncology

The role highly selective Acupressure therapy in the management of high risk craniovertebral junction tumor having same pathophysiology as Gamma knife works.

--Manuscript Draft--

Manuscript Number:	
Full Title:	The role highly selective Acupressure therapy in the management of high risk craniovertebral junction tumor having same pathophysiology as Gamma knife works.
Article Type:	Clinical Study
Keywords:	Highly selective, Acupressure therapy, Gamma Knife, Apoptosis.
Corresponding Author:	Khetan Kumar Prakash, MBBS, MS, Mch (Neurosurgery) Neurospinal centre Allahabad, Uttar Pradesh INDIA
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	Neurospinal centre
Corresponding Author's Secondary Institution:	
First Author:	Khetan Kumar Prakash, MBBS, MS, Mch (Neurosurgery)
First Author Secondary Information:	
Order of Authors:	Khetan Kumar Prakash, MBBS, MS, Mch (Neurosurgery)
	Agrawal Prasad Jagdish, Graduate
	Sharma Kumar Ram, Graduate
Order of Authors Secondary Information:	
Funding Information:	
Abstract:	Although there was no evidence to support are recommendation in regard to efficacy of highly selective Acupressure therapy.

Gamma knife
History

- Gamma knife is developed by swedish neurosurgeon Dr. LARS LEKSELL and colleague BORJE LARSON IN 1968.
- IT was introduce in US in 1987.
- More than 3 lac patients have been treated with Gamma knife surgery.

Gamma Knife Surgery

Gamma Knife radiosurgery is a type of radiation therapy used to treat tumors, vascular malformations and other abnormalities in the brain.

Contin…….

Gamma Knife radiosurgery, like other forms of stereotactic radiosurgery (SRS), is not surgery in the traditional sense because there is no incision.

Cont…….

Instead, Gamma Knife radiosurgery uses specialized equipment to focus about 200 tiny beams of radiation on a tumor or other target with submillimeter accuracy. Although each beam has very little effect on the brain tissue it passes through, a strong dose of radiation is delivered to the place where all the beams meet

Contin…….

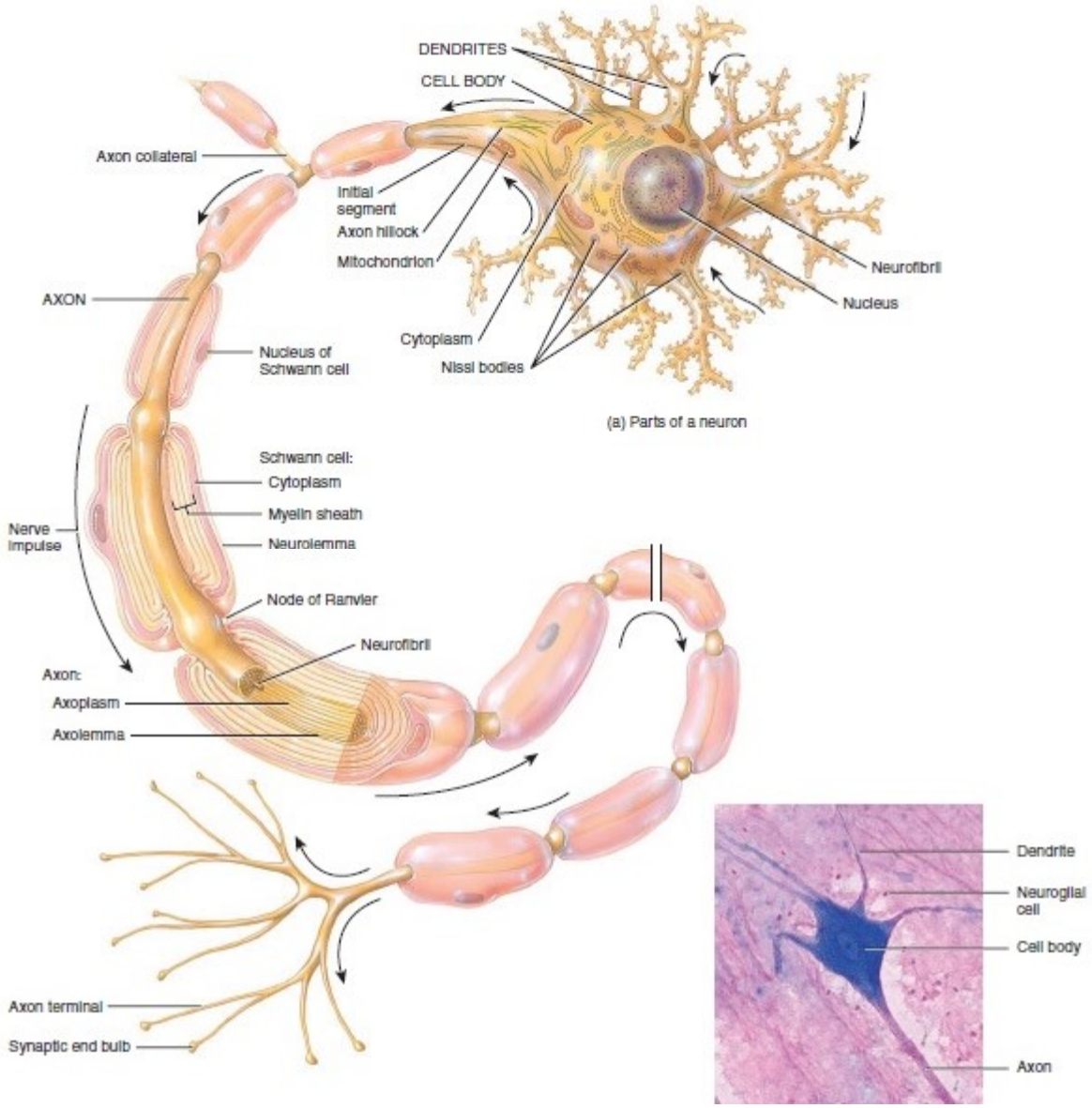
- The precision of brain stereotactic radiosurgery results in minimal damage to healthy tissues surrounding the target.
- Gamma Knife radiosurgery is usually a one-time therapy completed in a single day.

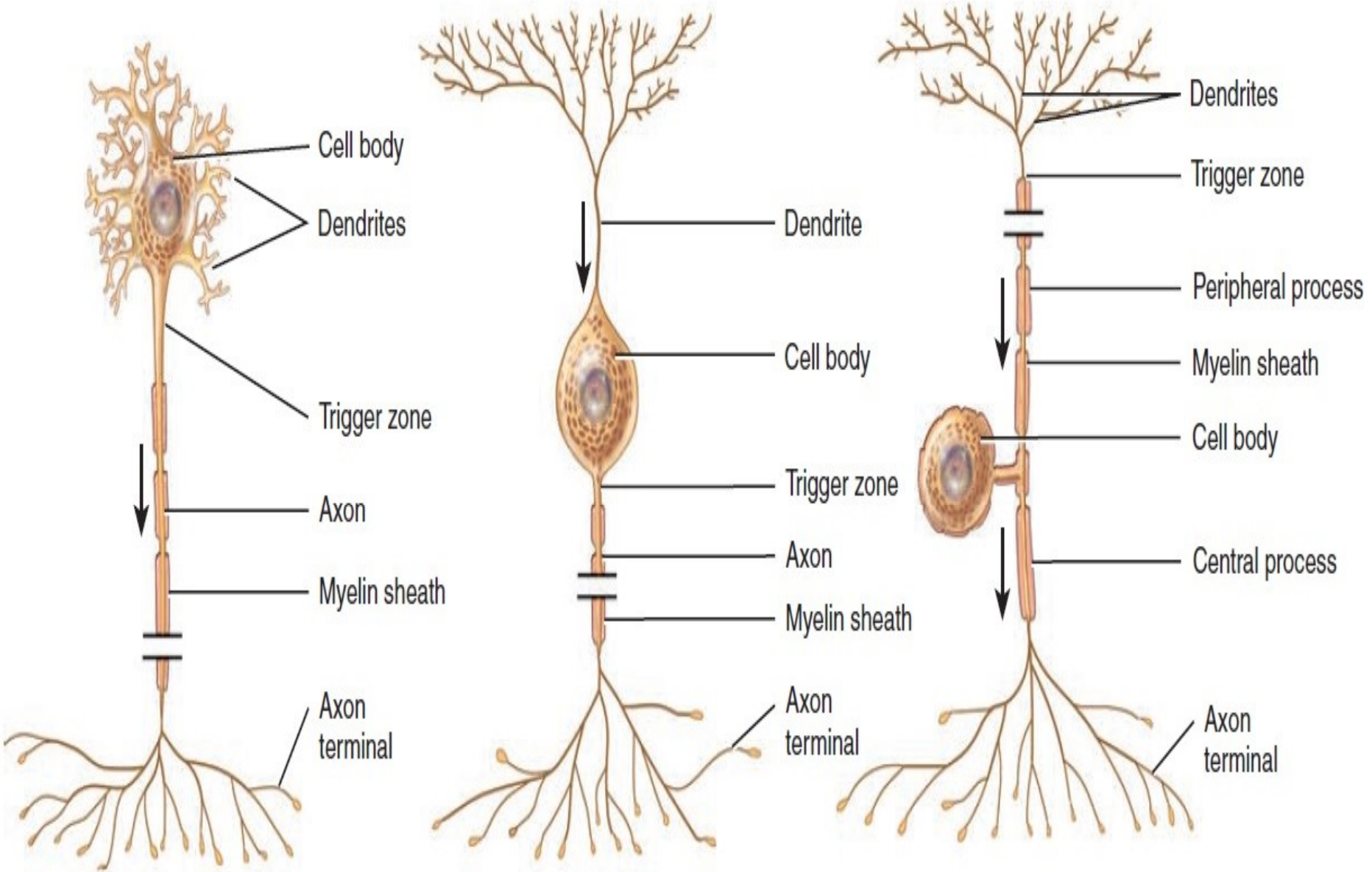
Conti…

Combining the latest in diagnostic imaging techniques and state-of-the-art 3D treatment planning software, the Gamma Knife Perfexion uses up to 200 radiation beams to treat designated targets, while sparing surrounding healthy tissue from treatment. Individually, the radiation beams are weak and pass through healthy tissue with minimal effect. The radiation treatment dose is delivered at the specific, designated spot where the different beams converge.

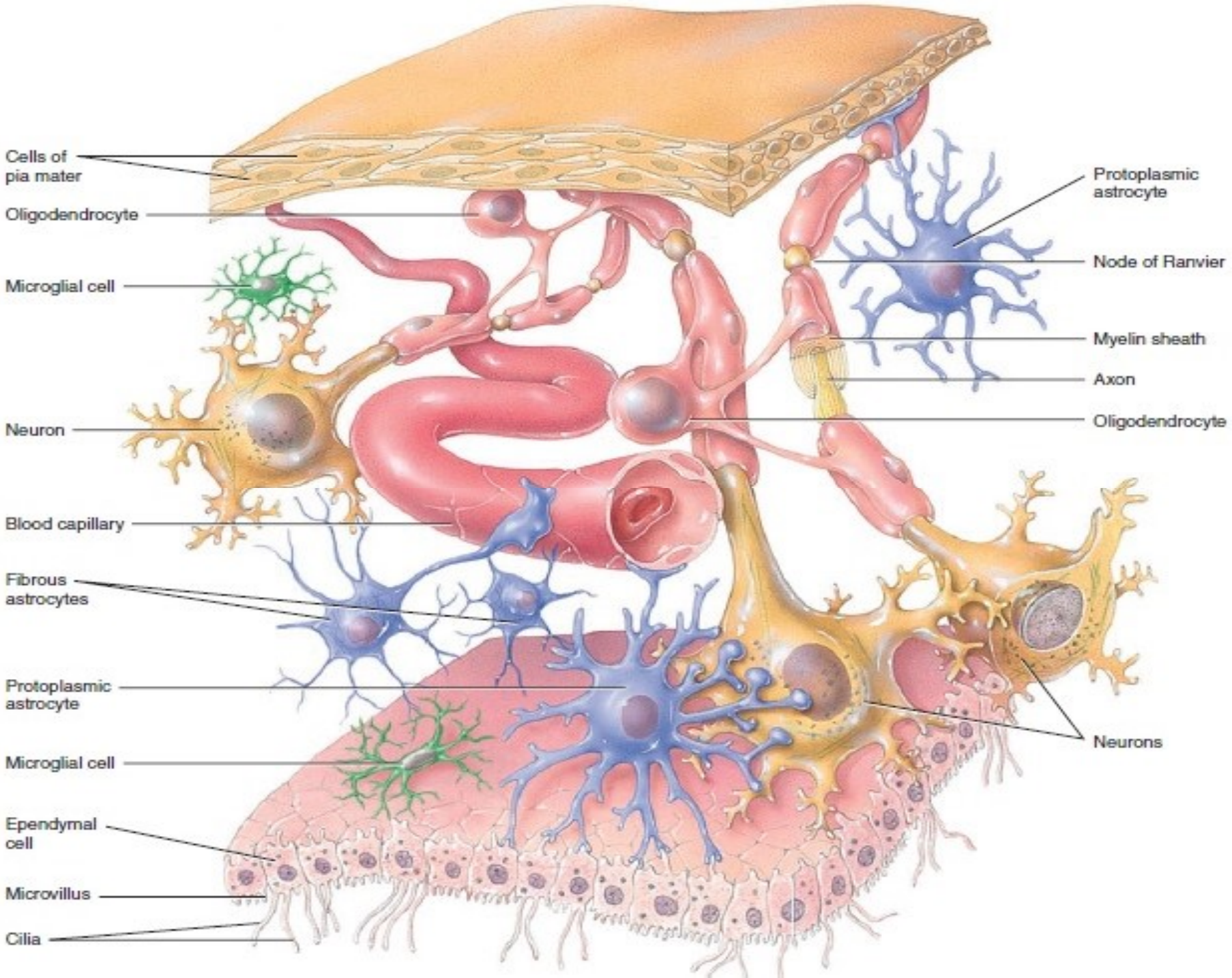
How does Gamma Knife Work?

- Radiosurgery for tumor treatment works by damaging or destroying the DNA of tumor cells so that these cells cannot reproduce or grow. Over time, the brain tumor shrinks.
- For blood vessel malformations, such as an arteriovenous malformation, Gamma Knife treatment causes the malformed blood vessels gradually to close off.
- When nerves are the target for treatment, as in the case of the pain disorder trigeminal neuralgia, radiosurgery diminishes the function of improperly acting nerves, which provides relief.


DENDRITES
CELL BODY
Axon collateral
Initial segment
Axon hillock
Mitochondrion
Neurofibril
Nucleus
AXON
Cytoplasm
Nissl bodies
Nucleus of Schwann cell
(a) Parts of a neuron
Schwann cell:
Cytoplasm
Myelin sheath
Neurolemma
Nerve impulse
Node of Ranvier
Neurofibril
Axon:
Axoplasm
Axolemma
Axon terminal
Synaptic end bulb
Dendrite
Neuroglial cell
Cell body
Axon



(a) Multipolar neuron (b) Bipolar neuron (c) Unipolar neuron


Cells of pia mater
Oligodendrocyte
Microglial cell
Neuron
Blood capillary
Fibrous astrocytes
Protoplasmic astrocyte
Microglial cell
Ependymal cell
Microvillus
Cilia
Protoplasmic astrocyte
Node of Ranvier
Myelin sheath
Axon
Oligodendrocyte
Neurons

Why it's done

- Gamma Knife radiosurgery is often a safer alternative to standard brain surgery (neurosurgery), which requires incisions in the skull, membranes surrounding the brain and brain tissue.

This type of radiation treatment is usually performed when:

- A tumor or other abnormality in the brain is too hard to reach with standard neurosurgery
- A person isn't healthy enough to undergo standard surgery
- A person prefers a less invasive treatment

Conti…

- In some cases, Gamma knife radiosurgery may have a lower risk of side effects compared with other types of radiation therapy.

Indications

- Brain tumours
- Brain metastasis
- Brain Pineal tumours
- Hemingioblastomas
- Hemingiopericytomas
- Benign or malignant Gliomas
- Head and neck cancers
- Behavioral disorders and movement disorders
- Obsessive- compulsive disorders

Cont…

- AV malformations
- Trigeminal neuralgia
- Itracatable epilepsy
- Parkinsons disease
- Essential tumours

Adverse effect of gamma knife surgery

- Nausea and headache: Both of which are usually treated to the applications and removal of the head brace required for the operation of the gamma knife's surgery-
  - Temporary imbalance
  - Numbness
  - Fatigue
  - Hair loss in target area
  - Expensive

Conclusion

- Gamma knife as a recognized as the safe treatment option. It has been in use for more than and over 30,000 patients wordwide benefited from this treatment.

Case Study 1 : Mr Yogesh Raj (M, 15yrs) by Ayurvedic Acupressure

INTRODUCTION AND BRIEF HISTORY:

Patient Mr Yogesh Raj – Mr. Yogesh Raj (M)

Age - 15 years

DOB- 9.10.1997

Mob-9473434996)

Address - Newada, Bihar

Conti…

- He was detected with *primary symptoms of sudden falling while walking and weakness in legs at the age of 14 yrs.* Due to sudden falls, his trousers used to get badly torn.
- Therefore he was tested under Allopathic at Patna initially.

Cont…

- The (1st) CT Scan Brain (dated 31.1.12) was normal.
- The (2nd) MRI of Cervical spine (dated 31.1.12) showed *diffuse swelling from lower brain stem to upper cervical cord upto C5.*

Referred to AIIMS,New Delhi

- Then after, patient's relatives consulted the Department of Neurosurgery at AIIMS, New Delhi where (3rd) MRI of Cervical spine with contrast (dated 11.2.12) revealed a *mass like lesion from lower brain stem upto C 5-6*.

Opinion of doctors

- As per doctor's views, surgery was risky with a mortality and morbidity rate greater than 50% , and life expectancy generally not more than 1 year; hence the family was reluctant towards surgery and decided to go for alternative therapy i.e Acupressure at Allahabad.

CT Brain

- **CT Scan Brain (31.1.12, Patna)** was normal

MRI of Cervical spine
31.1.12 (Patna)

Showed *diffuse swelling of upper cervical cord and lower brain stem including medulla and part of pons, showing slightly inhomogenous T2 hyper intense signal changes upto C5.*

MRI of Cervical Spine with Contrast 11.2.12 (New Delhi)

Showed- *bulbous expansion of lower part of brainstem, including fusiform expansion of upper part of cervical cord due to likely mass like lesion(? Glioma) showing patchy but intense enhancement following administration of contrast, and hyperintensities on T2 weighted images are seen extending from lower part of pons through C5-6 invertebral disc level. Lower part of 4rth ventricle is partially effaced*

MRI of Brain and Cervical Spine –contrast, enhanced 22.3.14 (Allahabad)

Large intramedullary heterogeneous solid cum cystic space occupying lesion (7.5x3.7x3.1cm) is seen in region of medulla oblongata, cervico-medullary junction and upper cervical spinal cord (upto C3 vertebra level). Lesion has large inhomogeneous solid enhancing component and non-enhancing ***cystic/necrotic component*** in superior part of lesion. Perifocal ill-defined T2 hyperintense non-enhancing edema like signal is seen extending inferiority up to C6 vertebral level with expansion of brain stem and cervical spinal cord.

- Upper part of lesion is seen related to inferior part of fourth ventricle with mild dilation of third and bilateral lateral ventricles with ***subtle periventricular ooze***.
- **Impression: Likely Neoplastic; Differential diagnosis: 1. Astrocytoma 2. Ependymoma**

MRI of Brain and Cervical Spine –contrast, enhanced 16.4.15 (Allahabad)

Large intramedullary heterogeneous T2 hyperintense solid cum cystic space (size 8.2x3.9x3.8cm) is seen in region of medulla oblongata, cervico-medullary junction and upper cervical spinal cord (up to C3 vertebra level). Lesion has large inhomogeneous solid enhancing component and non-enhancing ***cystic/ necrotic component*** in superior part of lesion. Perifocal ill- defined T2 hyperintese non- enhancing edema like signal is seen with expansion of brain stem and cervical spinal cord.

- Upper part of lesion is seen related to inferior part of fourth ventricle with mild dilatation of 3rd and bilateral lateral ventricles with **no periventricular ooze.**
- **Impression: Likely Neoplastic; Differential diagnosis: 1. Astrocytoma 2. Ependymoma**

MRI contrast, enhanced of CVJ 4.5.16, (Allahabad)

Large ill-defined heterogeneously enhancing expansible mass with cystic components in superior and inferior part of the lesion is seen involving medulla, left pons, left middle cerebral peduncle and upper spinal cord up to C2-C3 levels. Lesion measures approx. **8x3.7x3 cm**.

- T2 hyperintense signal suggestive of non enhancing tumour/perilesional edema in pons extending across midline, left middle cerebral peduncle, left cerebellum, medulla and upper spinal cord up to C6-C7 level.
- ***Features are concerning for neoplastic lesion, likely astrocytoma / Ependymoma***.

MRI of Brain- contrast, enhanced 21.7.2017 (Allahabad)

A **3.3x3.2x7.4cm** (AP, Tr, CC,) ill-defined mass lesion seen involving medulla, left cerebellar peduncles and cervical cord up to the level of C3 with expansion and lobulated contour of medulla and cord. Marked perilesional edema is seen extending up to lower dorsal pons, at anterior and left lateral aspect of 4^{th} ventricle and in cord up to the level of C6.

Conti…

- *As compared to previous MRI,* ***subtle reduction in size is noted with lesion not reaching ponto-medullary***
- ***junction*** *as in previous MRI. Inferior extent of lesion and perifocal edema remains status quo.*
- *Mild diffusion restricted noted.*
- *Post contrast scan demonstrated* strong enhancement in lower medulla and cord up to the level of C3 *with non-enhancing cystic areas at superior aspect. Enhancing areas and cystic component noted in left cerebellar penducles.*

Conti….

- *Marked asymmetric dilatation of 4th ventricle with T2/FLAIR hyperintensity at anterior and left lateral aspect of the ventricle. Lateral and 3rd ventricles are mildly dilated.* ***NO evidence of periventricular ooze.***

On comparison of above investigations, these **improvements by Acupressure treatment** are concluded –

- **Changes in lesion size –**
- MRI dated 4.5.16 - size = 8 x 3.7 x 3 cm (Vol 88.8)
- MRI dated 21.7.17 - size = 3.3 x 3.2 x 7.4 cm (Vol78.14)
- **Changes in expanse areas of lesion** – reduction from involvement of pons, remaining from medullary area and below (MRIs dated 4.5.16, 21.7.17)
- **Prevention of tumor being necrotic/ malignant.**
- **Periventricular oozing stopped** (MRIs dated 22.3.14, 16.4.15)
- **Change of mass from solid to cystic –** Left cerebellar component (MRIs dated 4.5.16, 21.7.17)

Case Study 2 : Smt. Rashmi Saran (F/ 35yrs) by Ayurvedic Acupressure

Bedriddencase

INTRODUCTION AND BRIEF HISTORY

- Patient Name : Smt. Rashmi Saran
- Age - 35 Yrs
- Address : Betia , Bihar, India
- Contact no. 7903588606

Cont…

- A female patient Smt. Rashmi Saran as such always in wheel chair and not able to stand and walk without any support.
- Speech and vision was not clear and feeling giddiness and headache off and on.

Doctors Opinion

- She discharged from the apex hospitals of the country after primary treatment with no further hope of recovery. According to doctors/modern science disease was incurable and all had been refused the case.

Came to ASPEUS

- The patient and her attendant came to ASPEUS with utter desperation for treatment by Acupressure as indoor patient at ASPEUS college. She was treated for from 08 Jan 18 to 12 Feb 2018. She was given treatment as per MRI report.

Patient had the following **SYMPTOMS** during the treatment -

(1) 10.11.2017 - Rigidity in lower jaw

(2) 10.11.2017 - unable to walk

(3) 10.11. 2017 - Slur speech

(4) 29.11.2017 - Swelling on face

(5) 01.12.2017 - Rigidity in right sided body (Upper limb > Lower limb)

(6) 01.12.2017 - Right eye - blurred vision

(7) Constipation - Chronic

MRI-Whole spine screening with CEMRI cervical Spine - (14 Dec 2017)

- Straighting of cervical spine is seen.
- Small posterior disco-osteophytic complexes are seen at C5 -C6 to C5- C6 level causing mild indentation of ventral thecal sac.
- Mild degenerative changes are seen in form of small marginal osteophytes at L4 and L5 level.
- Note is made of T2 hyperintensity in Pons and caudal midbrain which measures 25x20x18 mm in size and appear similar in size as compare to previous scan done 4 Dec. 2017.
- **Impression : Mild degenerative changes in cervical and Lumbar region.**
- **Normal appearance of spinal cord**

MRI-Whole spine screening with CEMRI cervical Spine -(14 Dec 2017)

- Straighting of cervical spine is seen.
- Small posterior disco-osteophytic complexes are seen at C5 -C6 to C5- C6 level causing mild indentation of ventral thecal sac.
- Mild degenerative changes are seen in form of small marginal osteophytes at L4 and L5 level.
- Note is made of T2 hyperintensity in Pons and caudal midbrain which measures 25x20x18 mm in size and appear similar in size as compare to previous scan done 4 Dec. 2017.
- ***Impression :*** **Mild degenerative changes in cervical and Lumar region.**
- **Normal appearance of spinal cord.**

Contrast -Enhanced MRI of Brain & MR Spectroscopy - (12th Feb 2018)

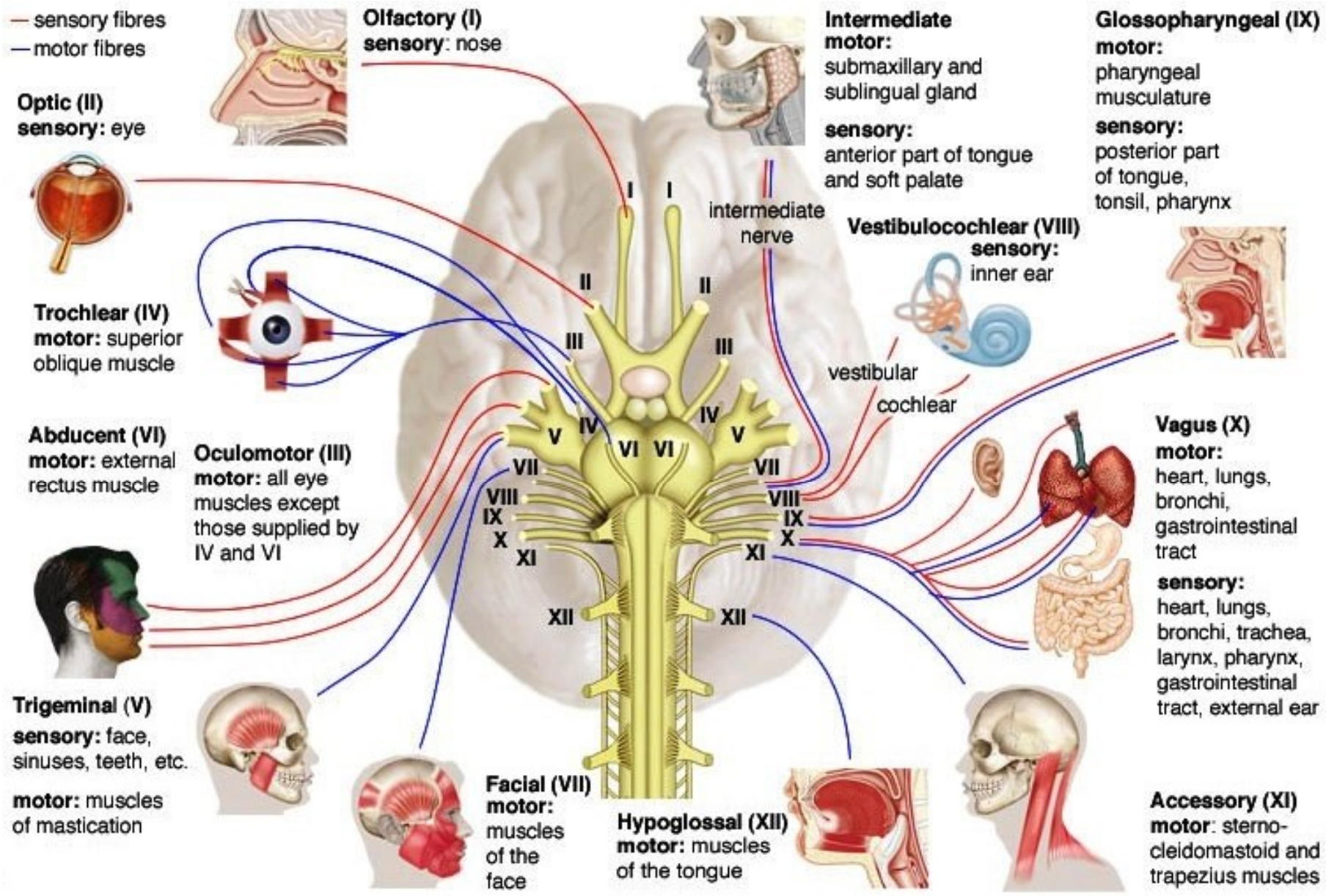
- **T2/FLAIR hyperintensity in pons with linear areas of post contrast enhancement. There is thickening with mild T2/FLAIR hyperintensity and enhancement in right superior peduncle.**
- **Mild leptomeningeal enhancement along right side of pons.**
- **On MR Spectroscopy, there is mild elevation of choline with reduced NNA peaks.**
- **Paranasal sinuses and Mastoid air cells : Mucosal thickening in B/L ethmoid sinus. Mild DNS to right with left inferior turbinate hypertrophy.**
- **Imaging DD include: neurosarcoidosis/Vasculitis/CLIPPERS (Chronic lymphocytic inflammation with pontine perivascular enhancement responsive to steroid).**
-

Blood report

- CRP - 7.50 (up to 5)
- Vitamin D deficiency

Treatment Result

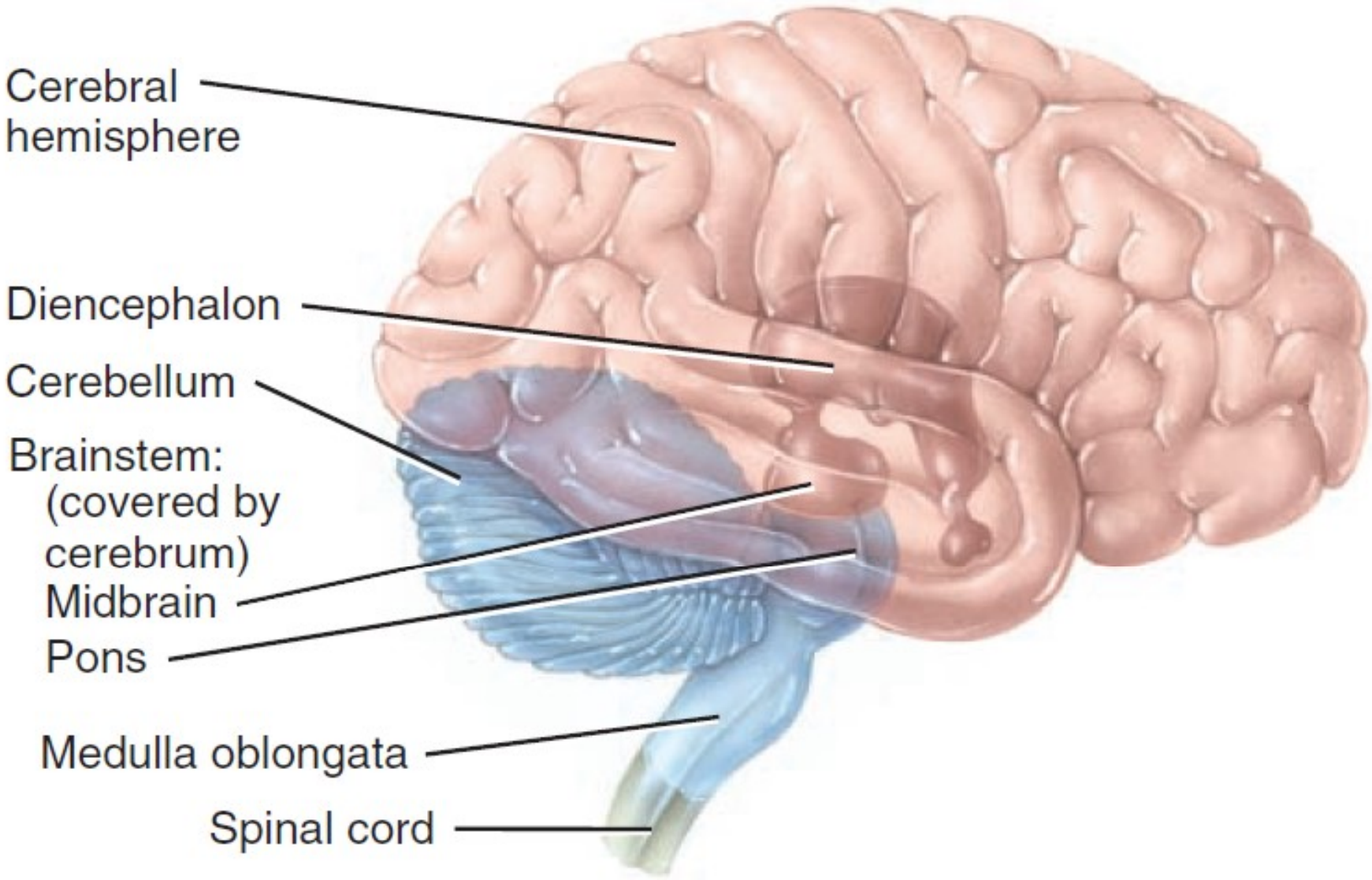
The patient gradually responded to treatment and ultimately went to home on her feet with marked recovery in vision and speech also.


— sensory fibres
— motor fibres
Olfactory (I)
sensory: nose
Optic (II)
sensory: eye
Trochlear (IV)
motor: superior oblique muscle
Abducent (VI)
motor: external rectus muscle
Oculomotor (III)
motor: all eye muscles except those supplied by IV and VI
Trigeminal (V)
sensory: face, sinuses, teeth, etc.
motor: muscles of mastication
Facial (VII)
motor: muscles of the face
Hypoglossal (XII)
motor: muscles of the tongue
Accessory (XI)
motor: sterno-cleidomastoid and trapezius muscles
Vagus (X)
motor: heart, lungs, bronchi, gastrointestinal tract
sensory: heart, lungs, bronchi, trachea, larynx, pharynx, gastrointestinal tract, external ear
Glossopharyngeal (IX)
motor: pharyngeal musculature
sensory: posterior part of tongue, tonsil, pharynx
Intermediate
motor: submaxillary and sublingual gland
sensory: anterior part of tongue and soft palate
intermediate nerve
Vestibulocochlear (VIII)
sensory: inner ear
vestibular
cochlear
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII

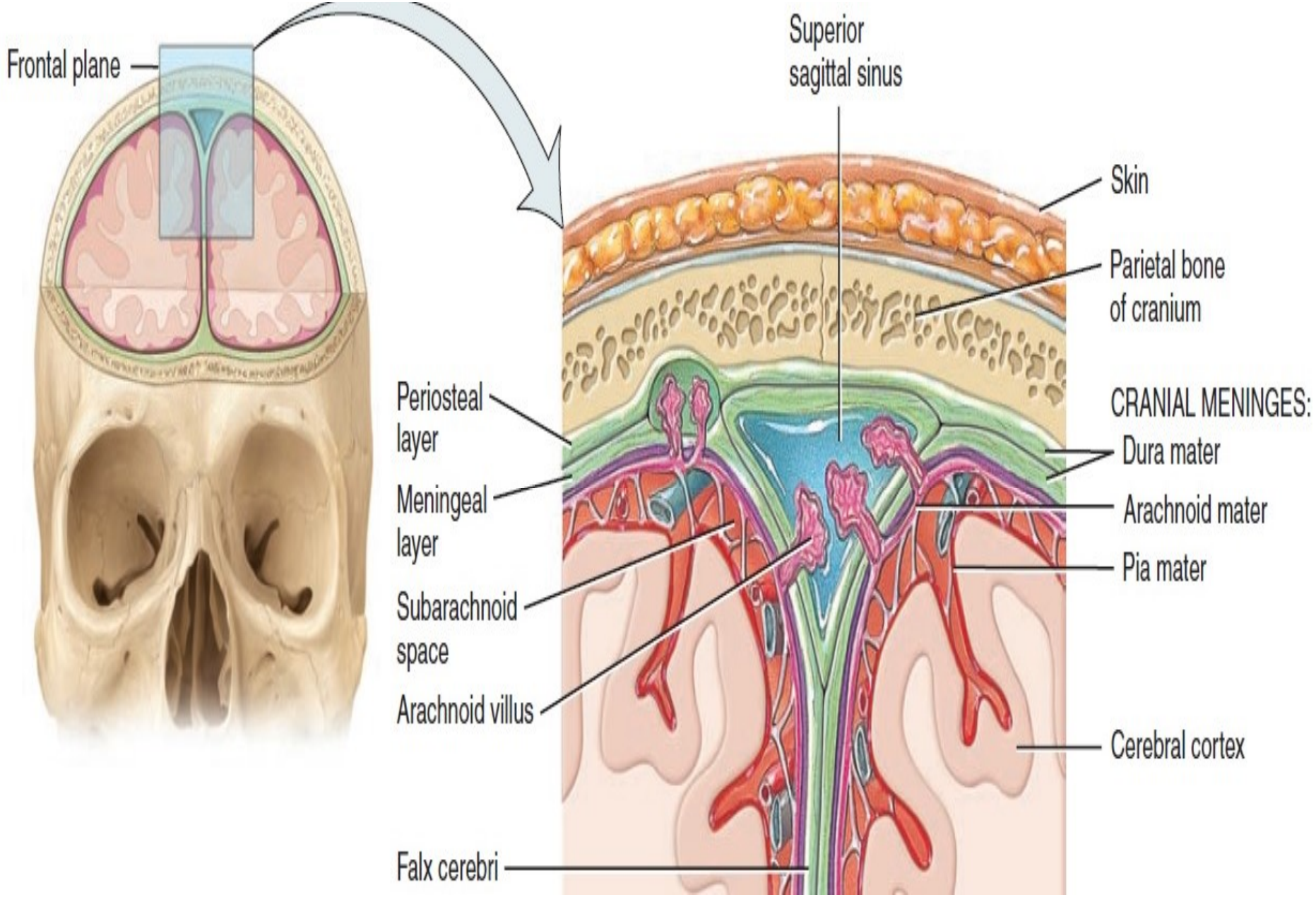
- Two hundred ten patients with cerebral metastases underwent GKS. Seven patients underwent subsequent craniotomy for tumor removal between 1 and 33 months after GKS. Four of these patients had one tumor, two patients had two tumors, and one patient had three. Histological and immunohistochemical investigations were performed. In addition to routine H & E and Mallory trichrome staining, immunohistochemical reactions were conducted to characterize the phenotypic nature of the cell population contributing to the tissue immune response to neoplastic deposits after radiosurgery. Light microscopy revealed an intensive lymphocytic infiltration in the parenchyma and stroma of tumor samples obtained in patients in whom surgery was performed over 6 months after GKS. Contrary to this, extensive areas of tissue necrosis with either an absent or scanty lymphoid population were observed in the poorly controlled neoplastic specimens obtained in cases in which surgery was undertaken in patients less than 6 months after GKS. Immunohistochemical characterization demonstrated the predominance of CD3-positive T cells in the lymphoid infiltration.

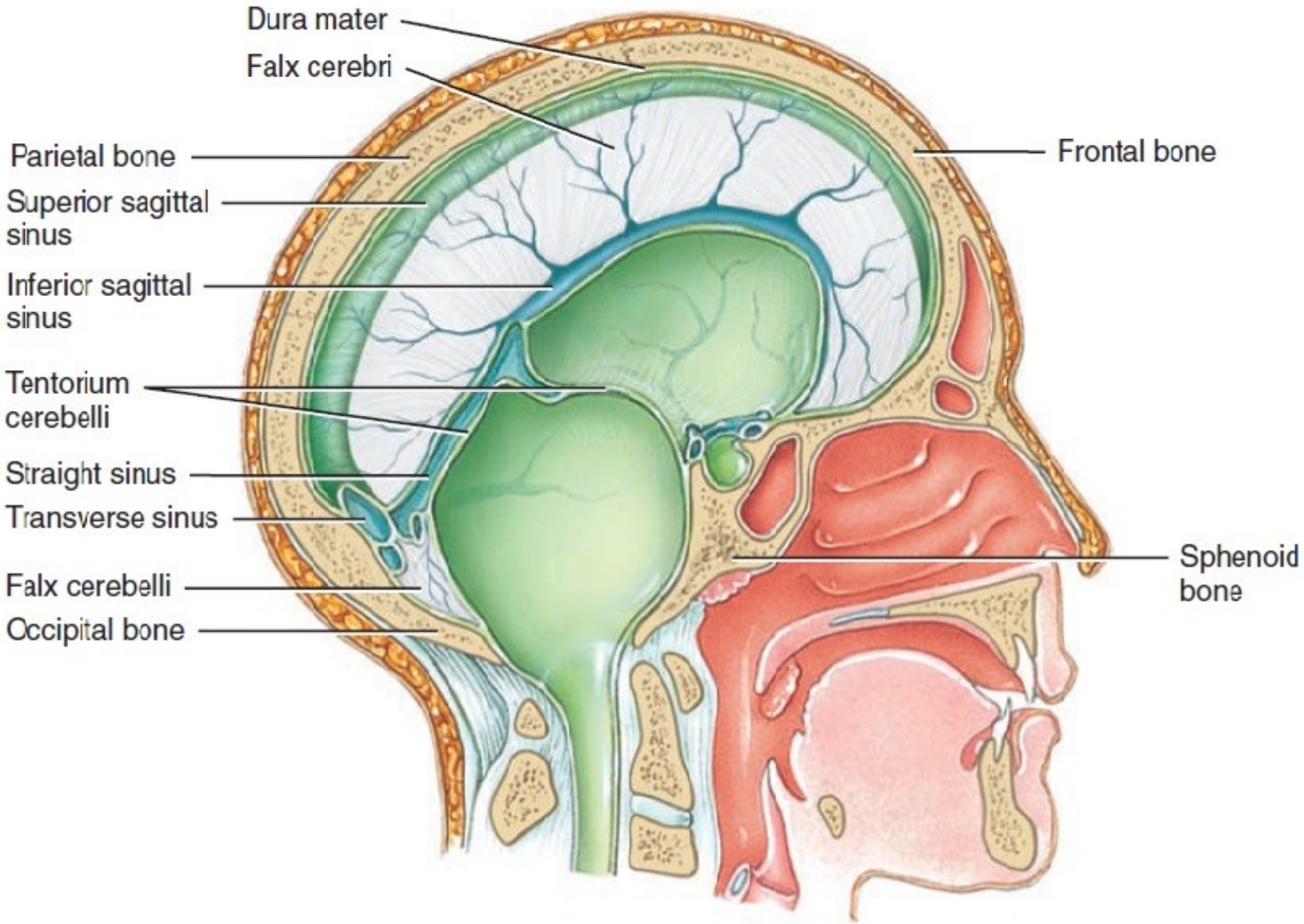
CONCLUSIONS

- Histopathological findings of the present study are consistent with a cellular immune response of natural killer cells against metastatic brain tumors, presumably stimulated by the ionizing energy of focused radiation.

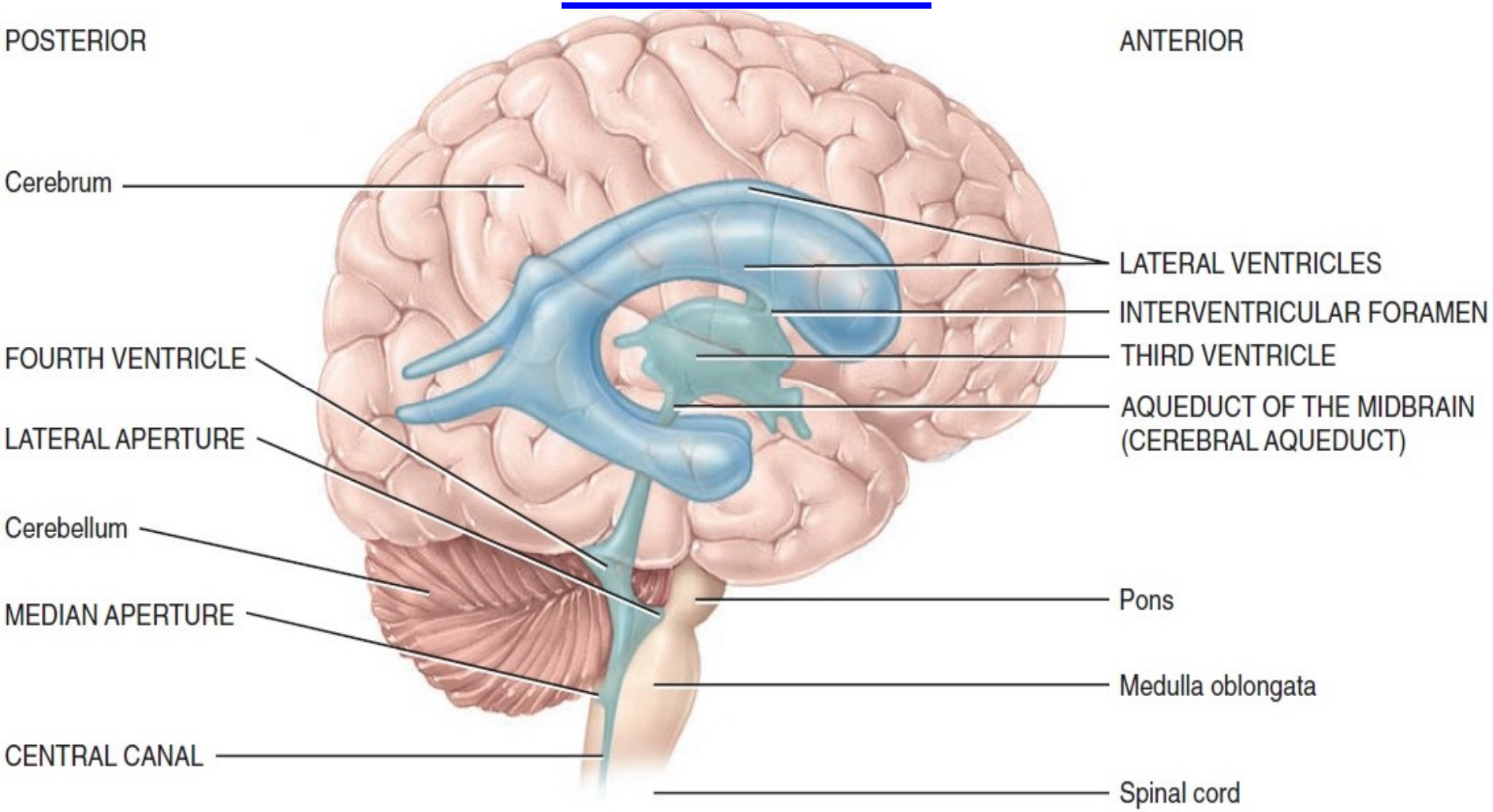


(d) Brain at birth (diencephalon and superior portion of brain stem projected to surface)

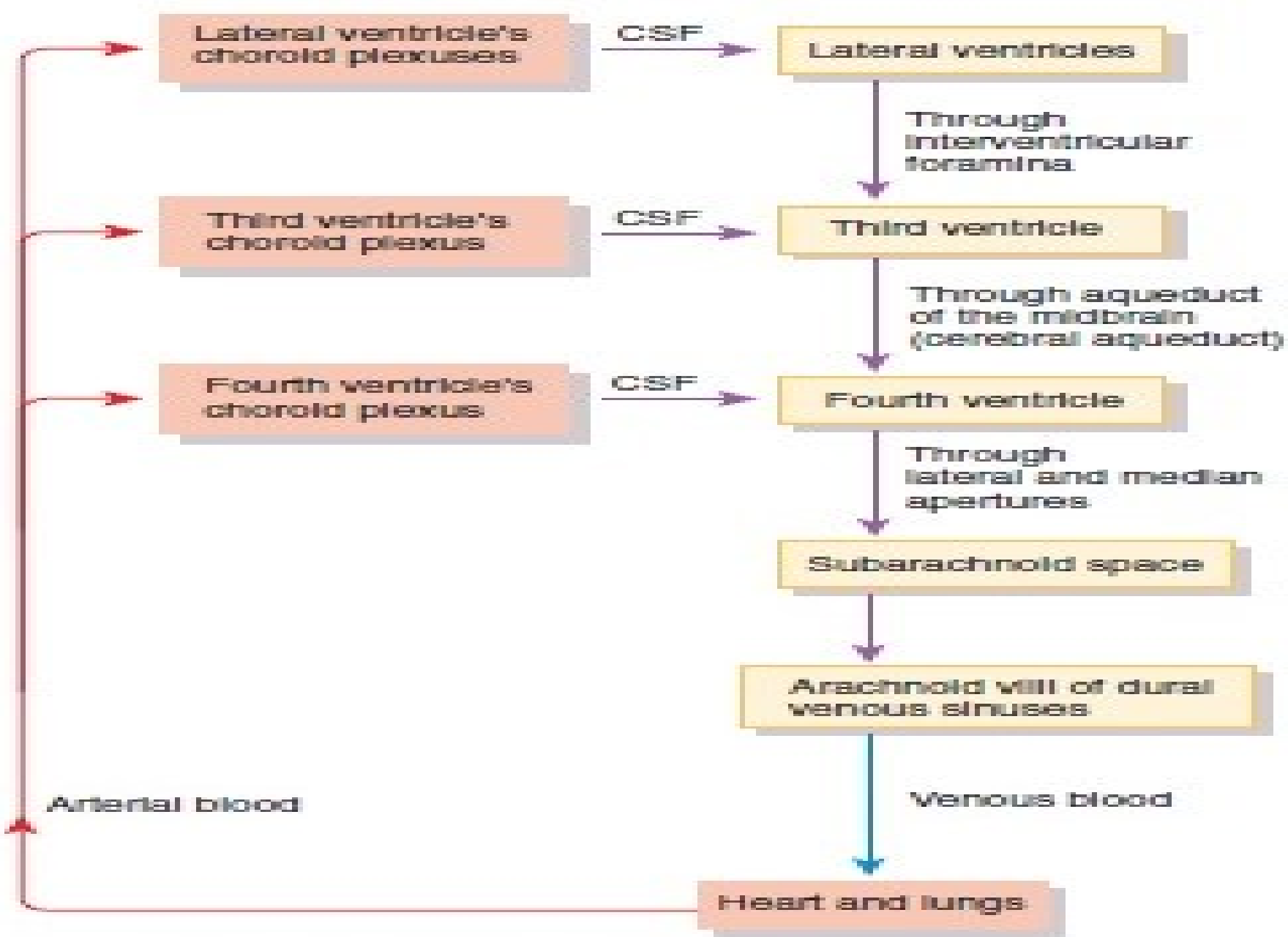

Frontal plane
Superior sagittal sinus
Skin
Parietal bone of cranium
Periosteal layer
CRANIAL MENINGES:
Dura mater
Meningeal layer
Arachnoid mater
Pia mater
Subarachnoid space
Arachnoid villus
Cerebral cortex
Falx cerebri


Dura mater
Falx cerebri
Parietal bone
Frontal bone
Superior sagittal sinus
Inferior sagittal sinus
Tentorium cerebelli
Straight sinus
Transverse sinus
Sphenoid bone
Falx cerebelli
Occipital bone

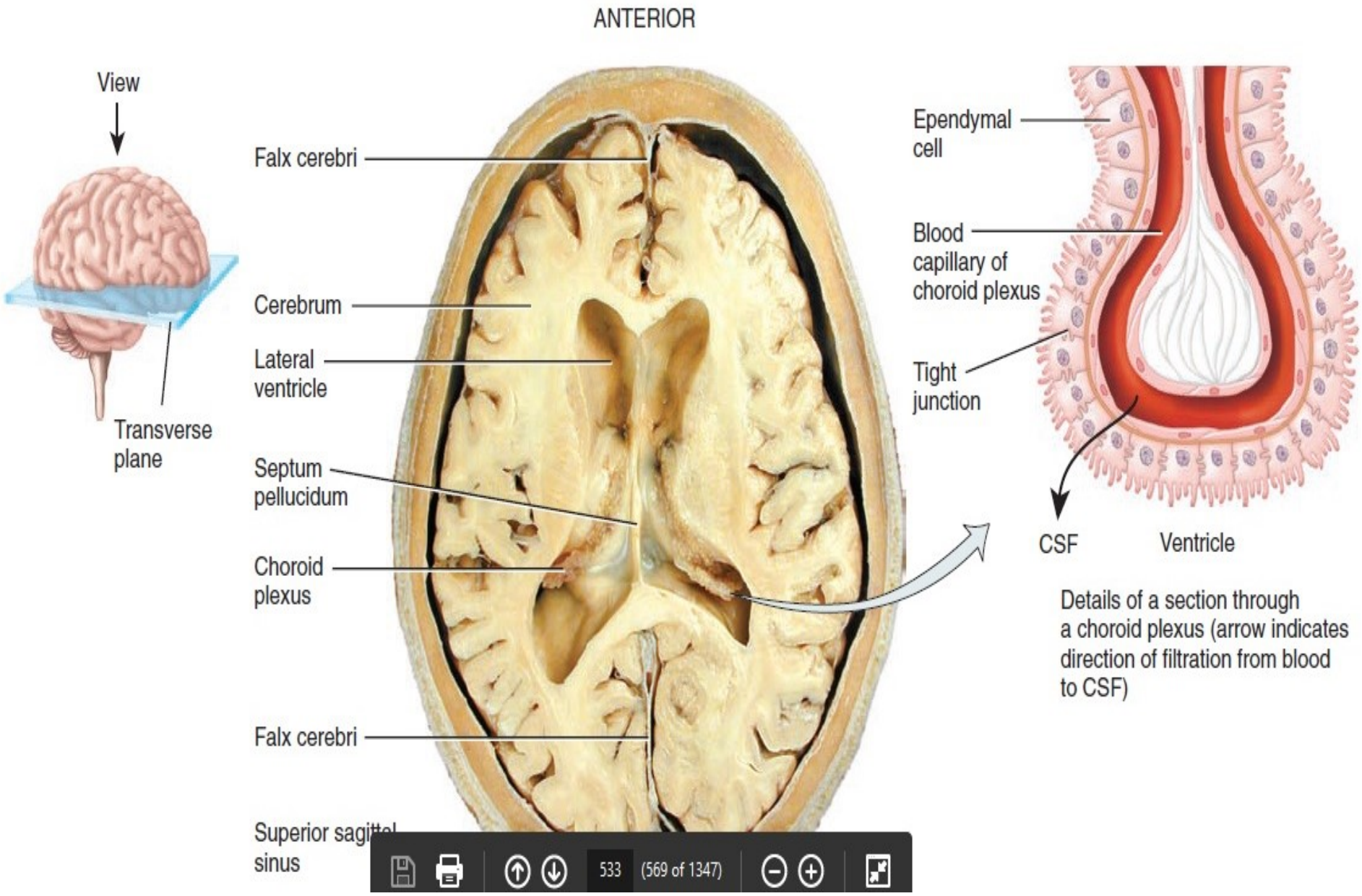
Ventricles

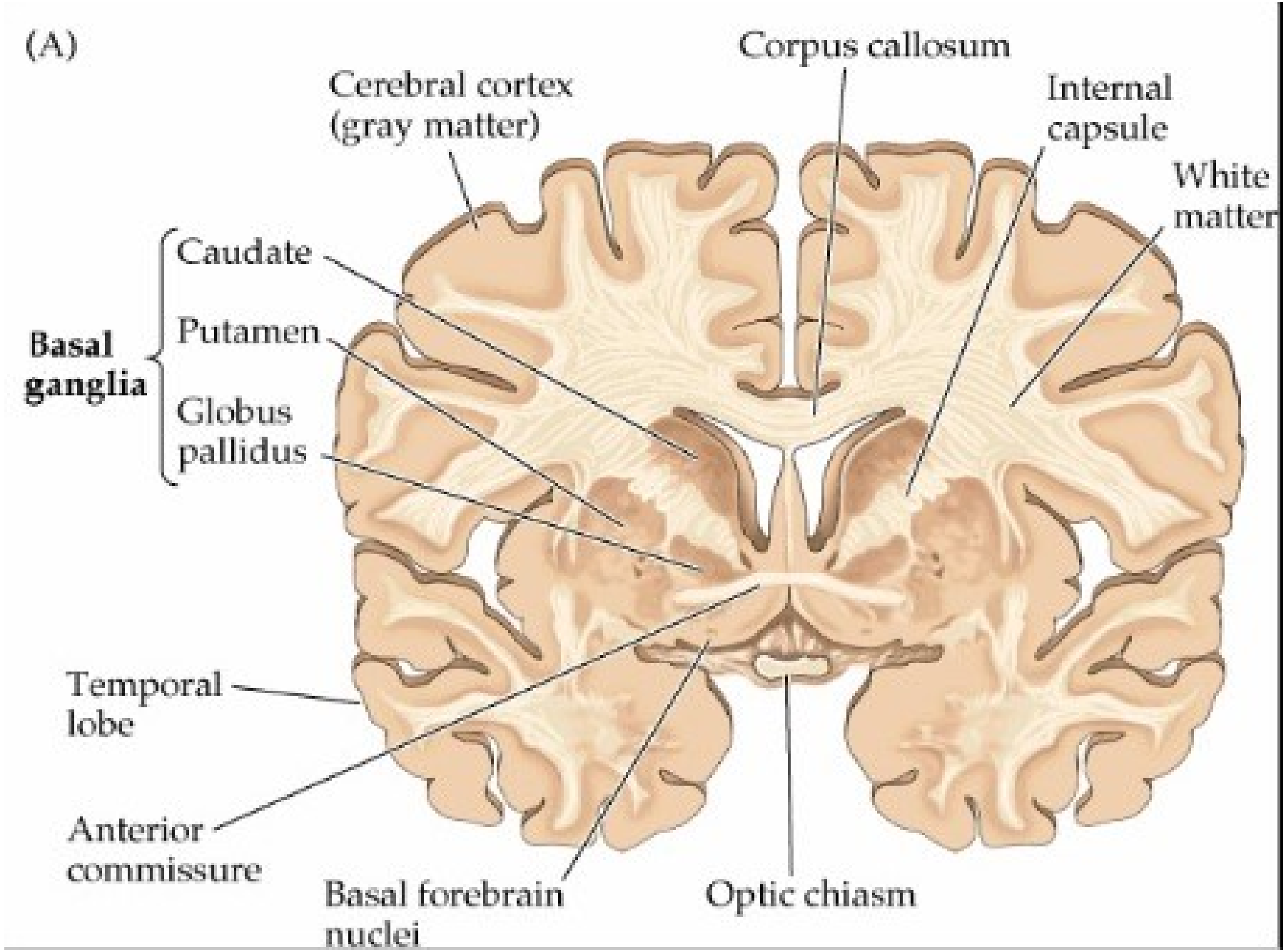


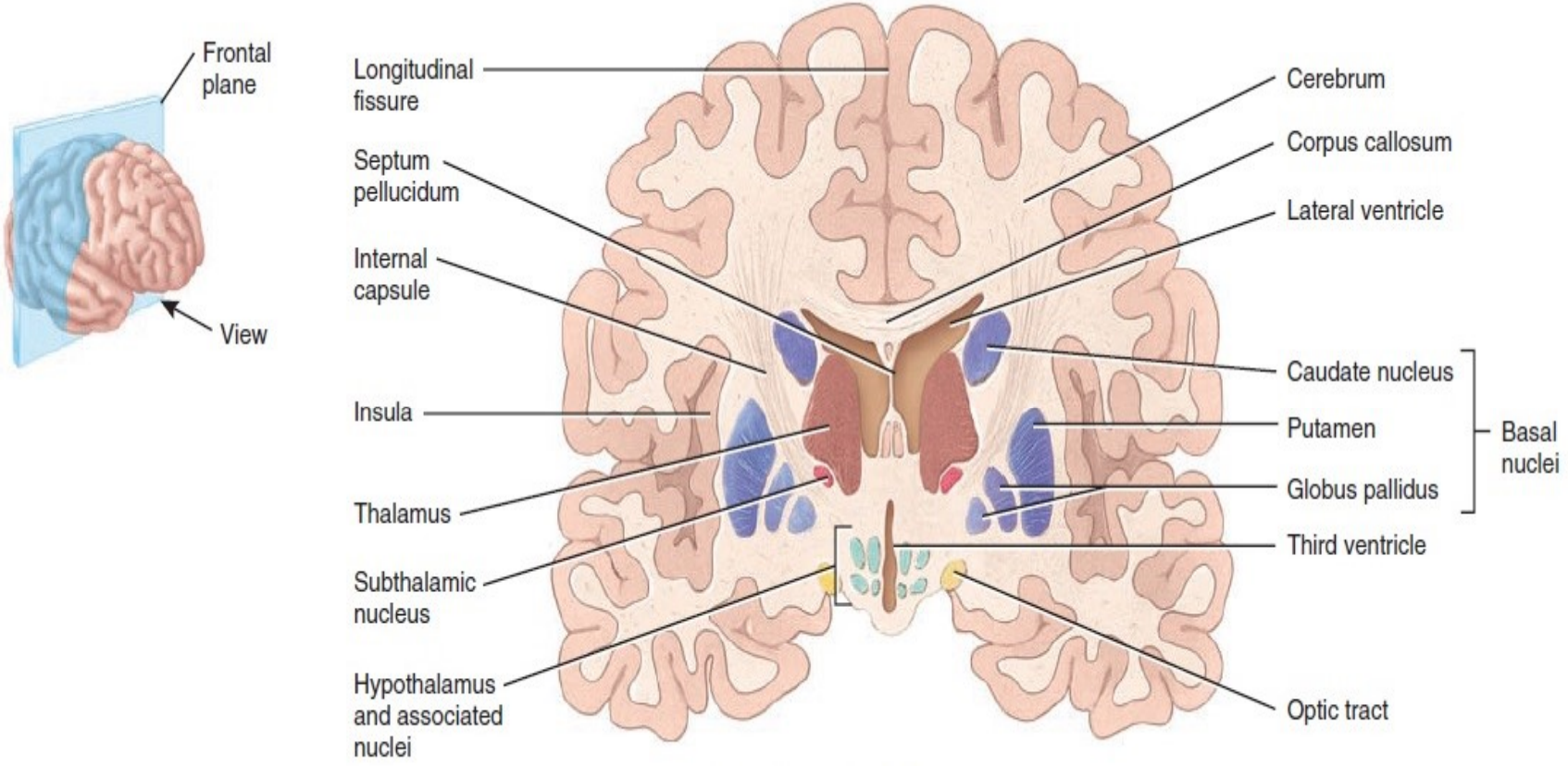
Right lateral view of brain



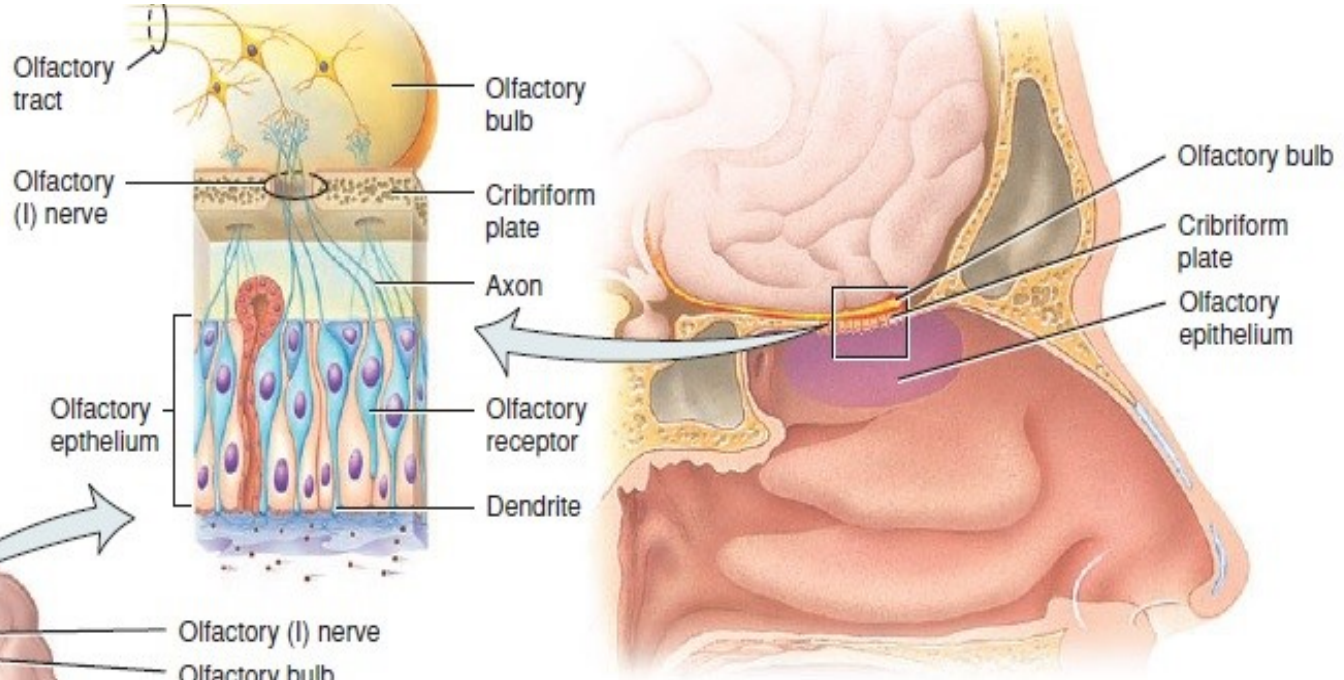
(d) Summary of the formation, circulation, and absorption of cerebrospinal fluid (CSF)

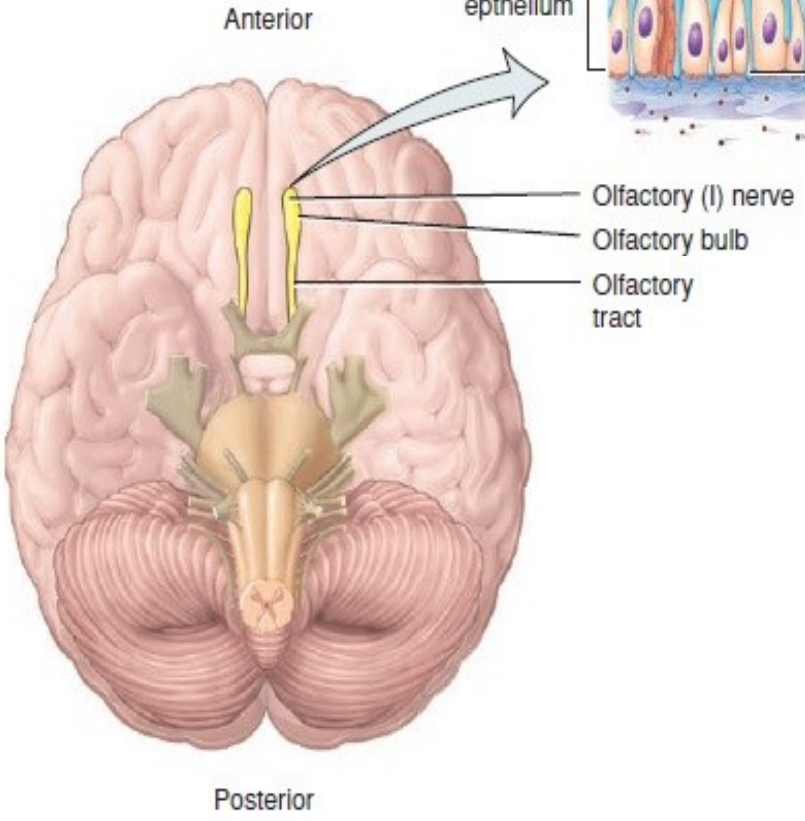

ANTERIOR
View
Transverse plane
Falx cerebri
Cerebrum
Lateral ventricle
Septum pellucidum
Choroid plexus
Falx cerebri
Superior sagittal sinus
Ependymal cell
Blood capillary of choroid plexus
Tight junction
CSF
Ventricle
Details of a section through a choroid plexus (arrow indicates direction of filtration from blood to CSF)
533
(569 of 1347)


(A)
Corpus callosum
Cerebral cortex
(gray matter)
Internal
capsule
White
matter
Caudate
Basal
ganglia
Putamen
Globus
pallidus
Temporal
lobe
Anterior
commissure
Basal forebrain
nuclei
Optic chiasm



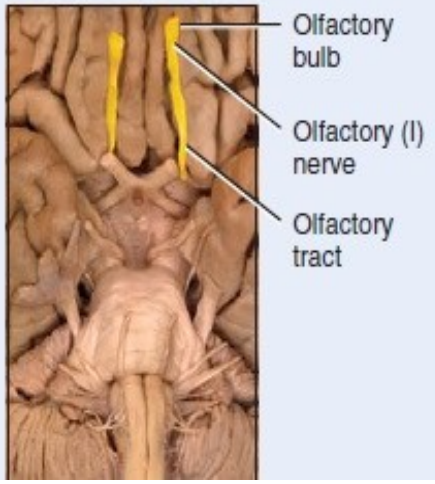
(b) Anterior view of frontal section



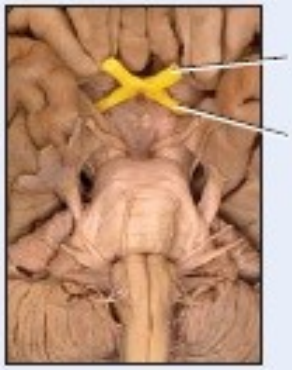


CLINICAL CONNECTION | *Anosmia*

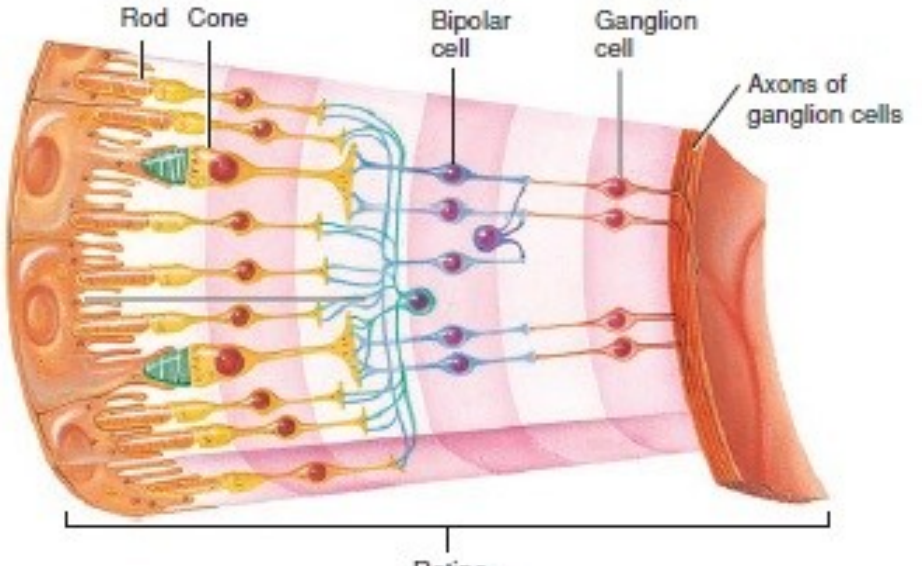
Loss of the sense of smell, called **anosmia** (an-OZ-mē-a), may result from infections of the nasal mucosa, head injuries in which the cribriform plate of the ethmoid bone is fractured, lesions along the olfactory pathway or in the brain, meningitis, smoking, or cocaine use. •

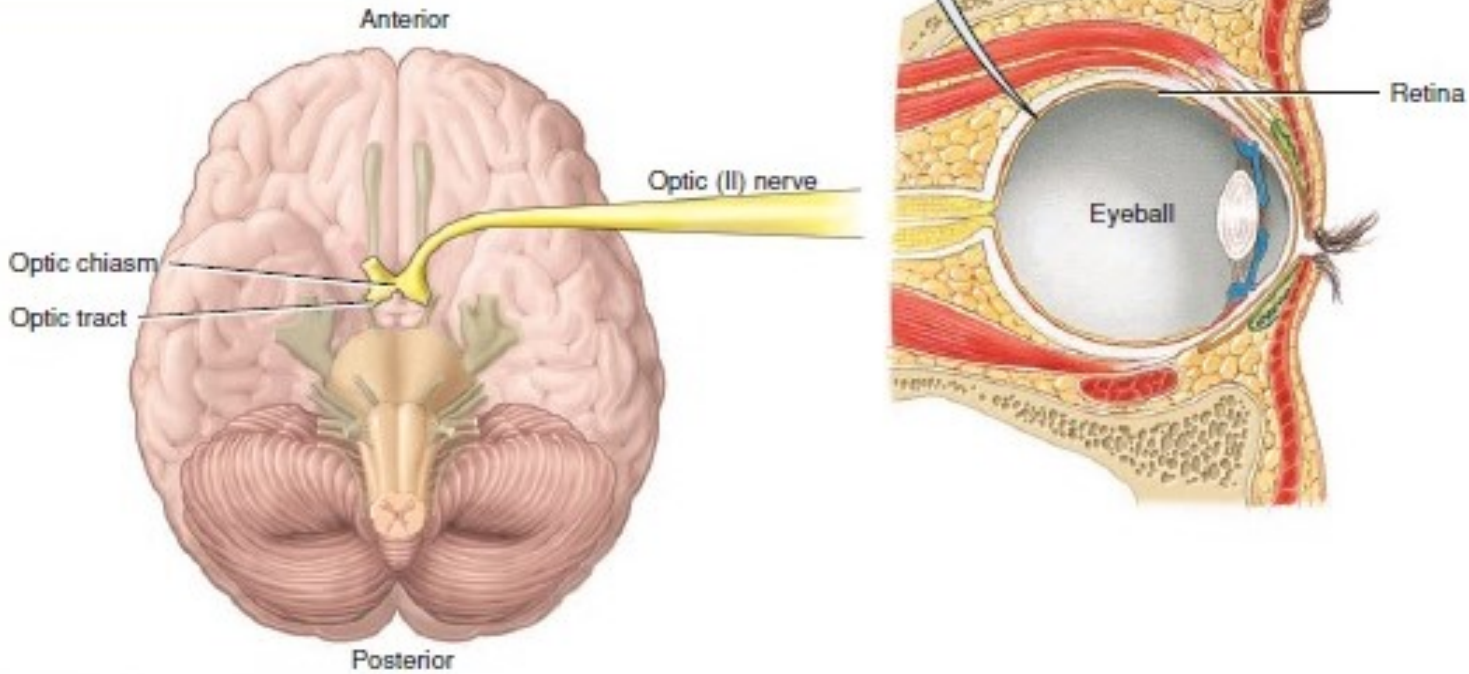


CLINICAL CONNECTION | *Anopia*

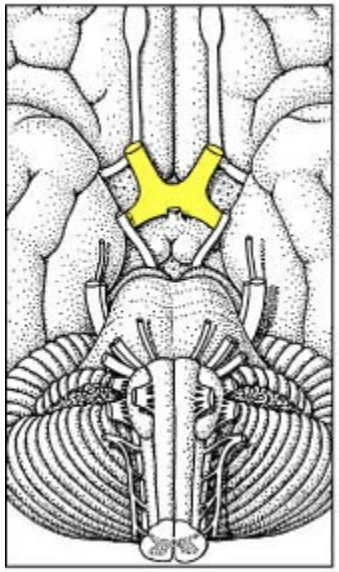


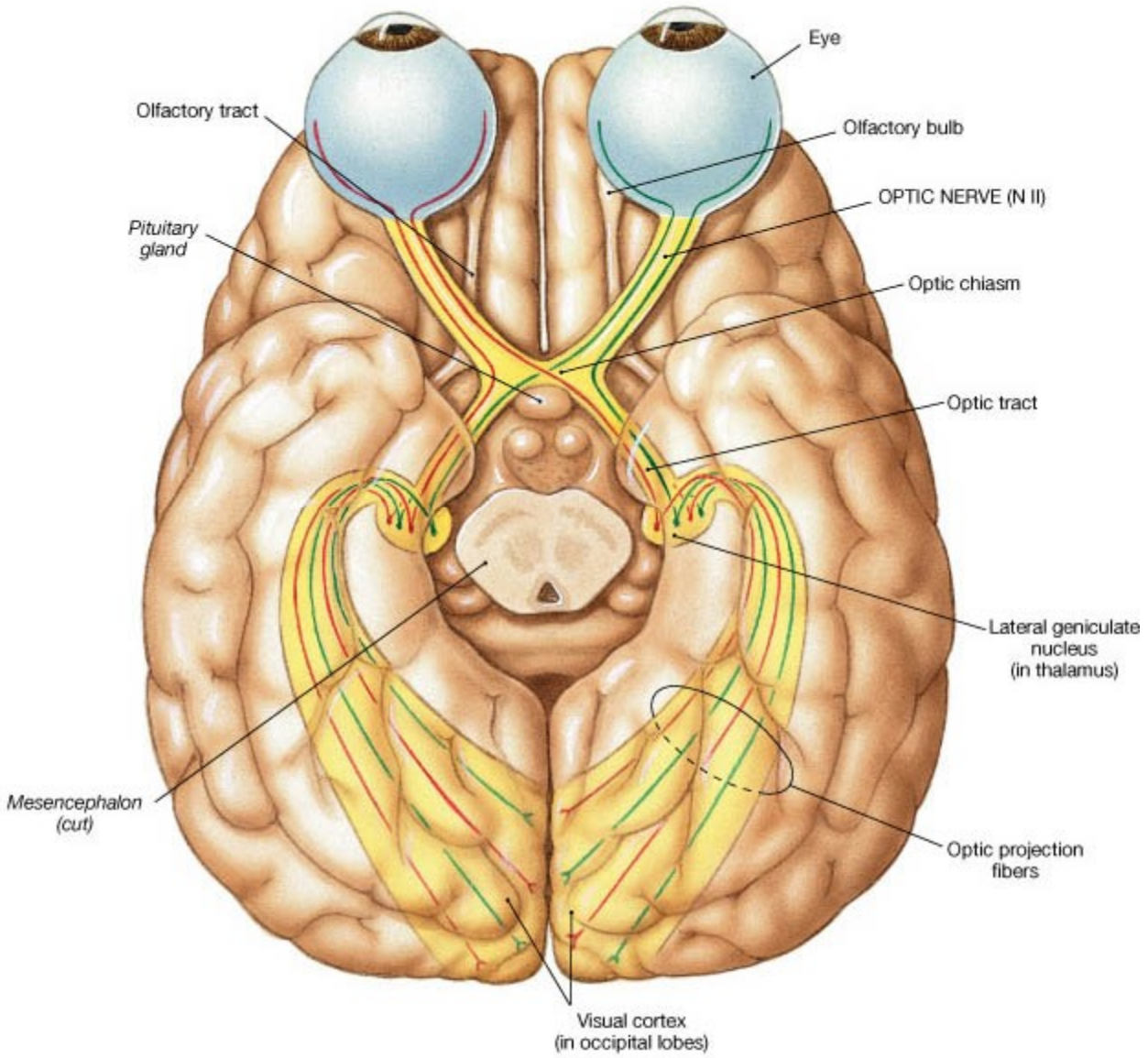
Fractures in the orbit, brain lesions, damage along the visual pathway, diseases of the nervous system (such as multiple sclerosis), pituitary gland tumors, or cerebral aneurysms (enlargements of blood vessels due to weakening of their walls) may result in visual field defects and loss of visual acuity. Blindness due to a defect in or loss of one or both eyes is called **anopia** (an-Ō-pē-a). •





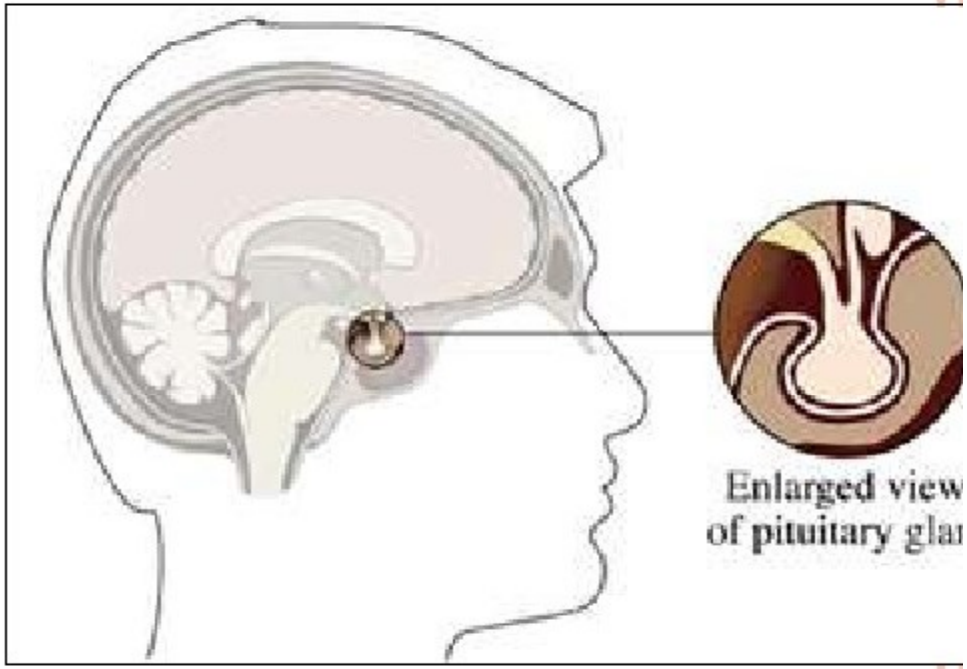
2 Where do most axons in the optic tracts terminate?



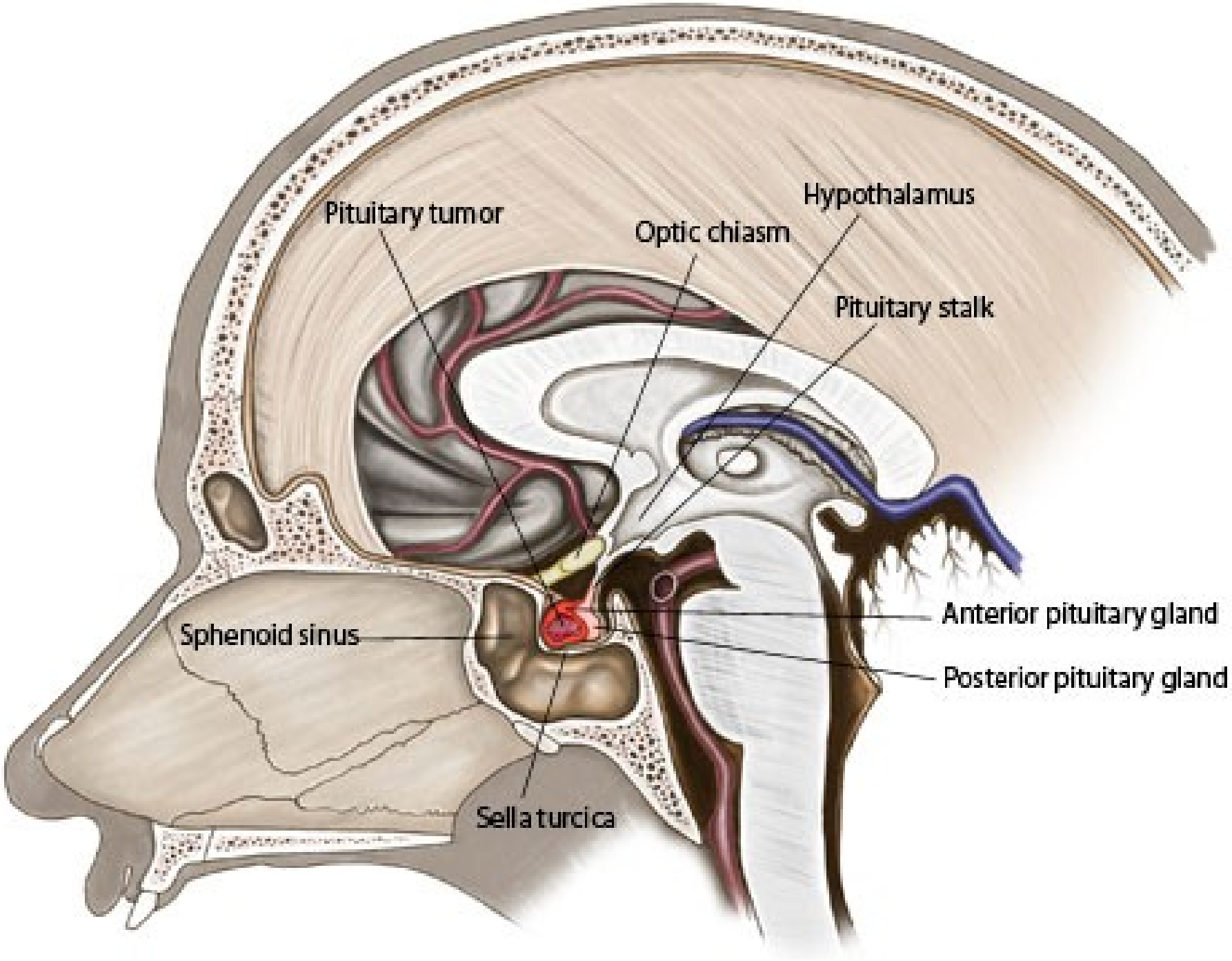

Eye
Olfactory tract
Olfactory bulb
OPTIC NERVE (N II)
Pituitary gland
Optic chiasm
Optic tract
Lateral geniculate nucleus (in thalamus)
Mesencephalon (cut)
Optic projection fibers
Visual cortex (in occipital lobes)

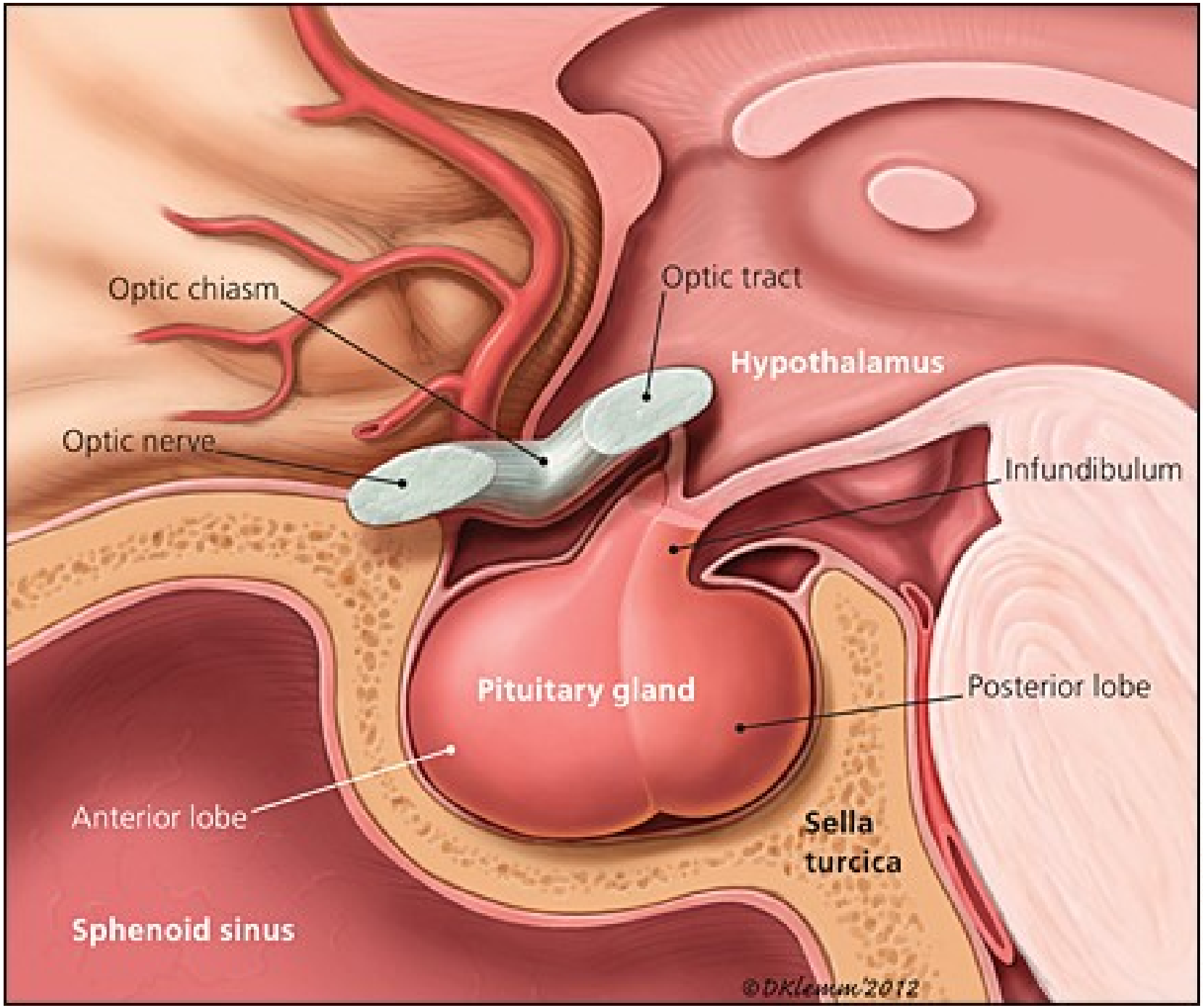
III. TUMORS OF THE PITUITARY GLAND

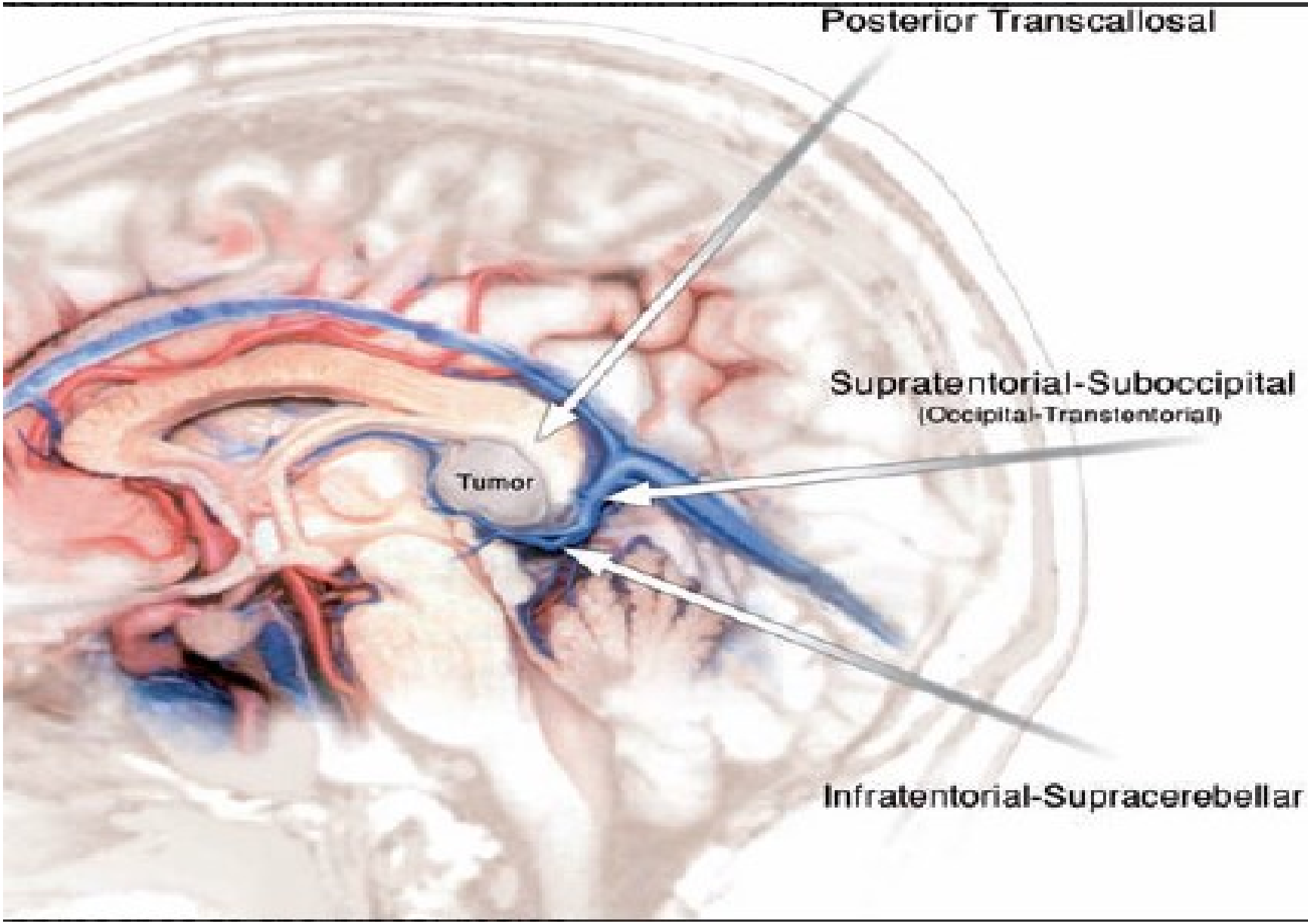
- Third most common primary brain tumor
- Often asymptomatic
- Incidence at autopsy: 1.7 – 24%
- Most common in adults in the 3rd and 4th decade

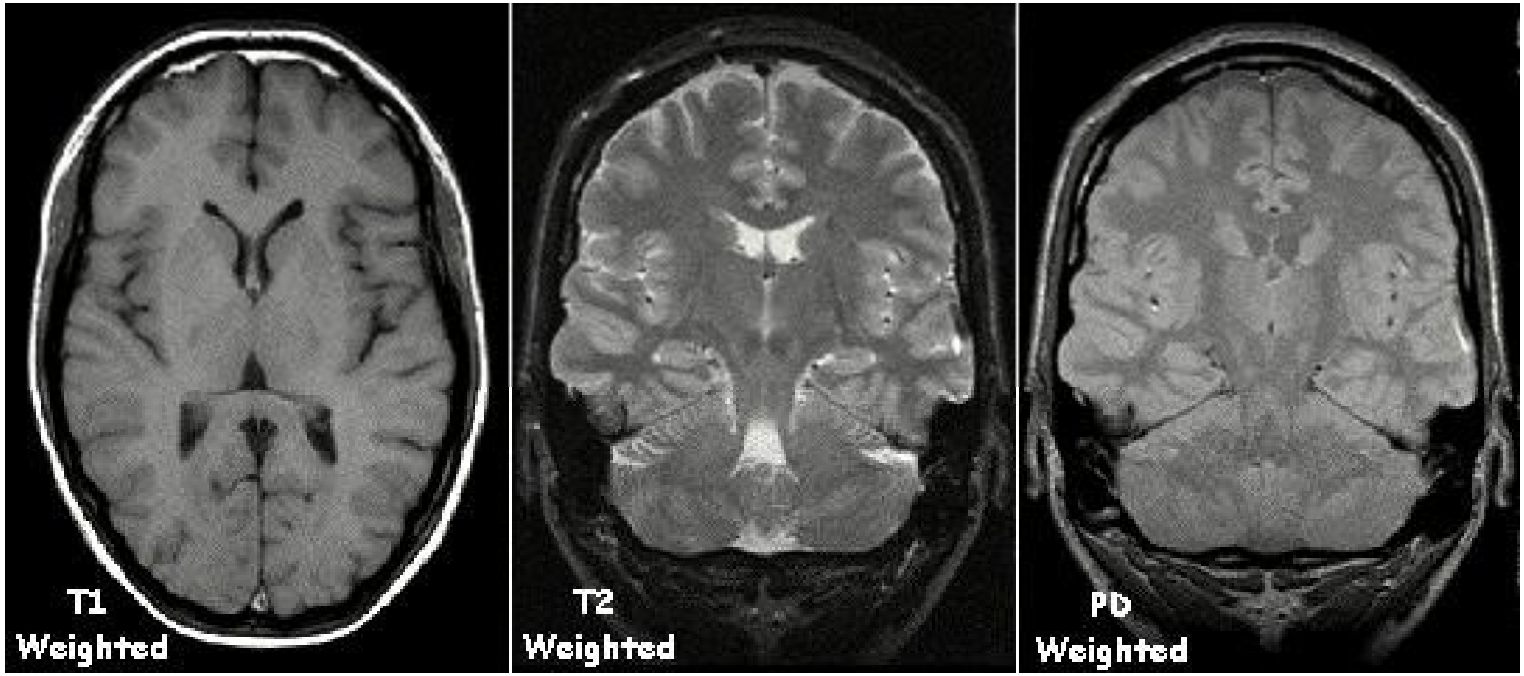


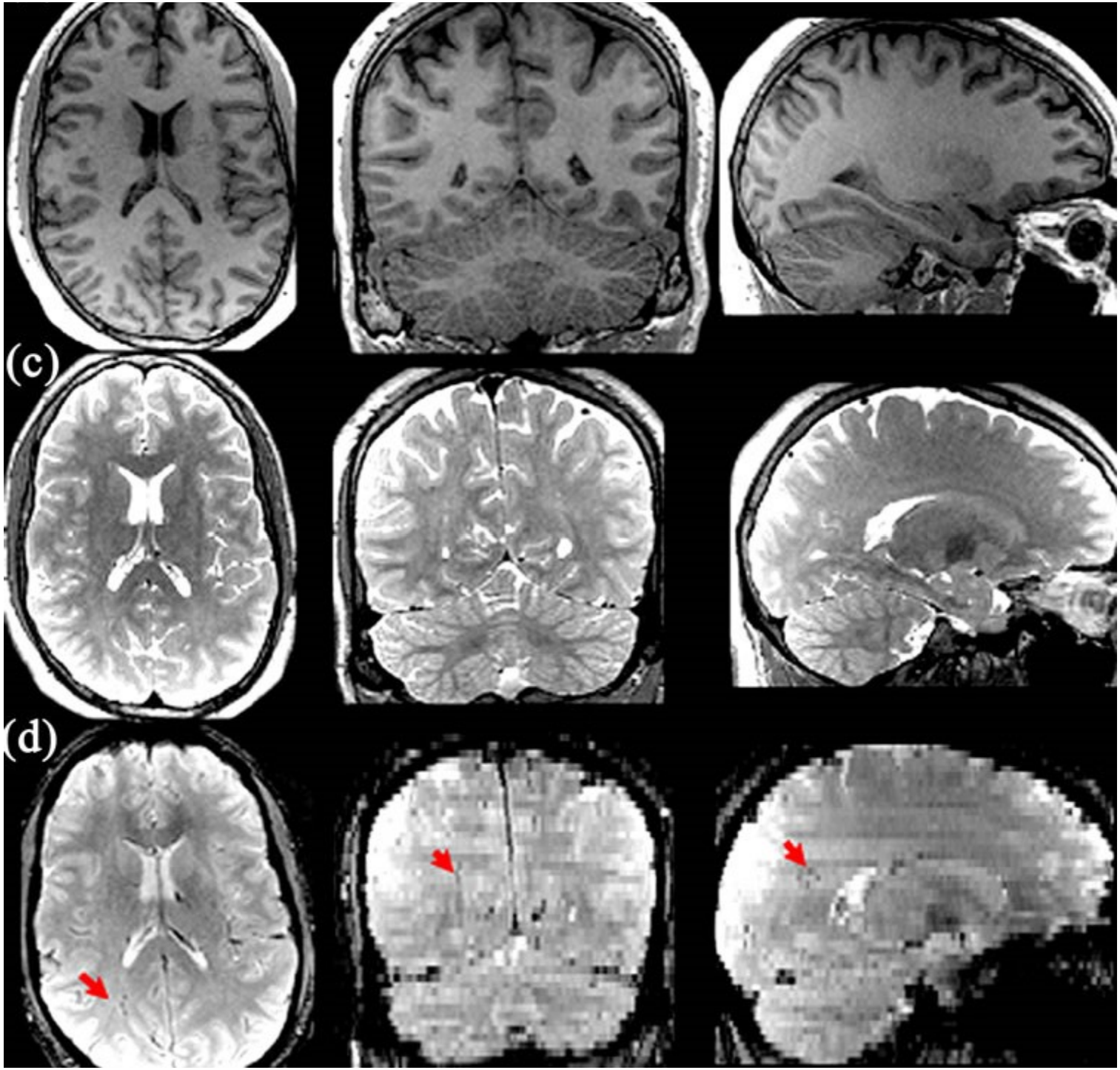
- 10% incidence in children & adolescents
- Not hereditary except MEN-1 (multiple endocrine neoplasia)

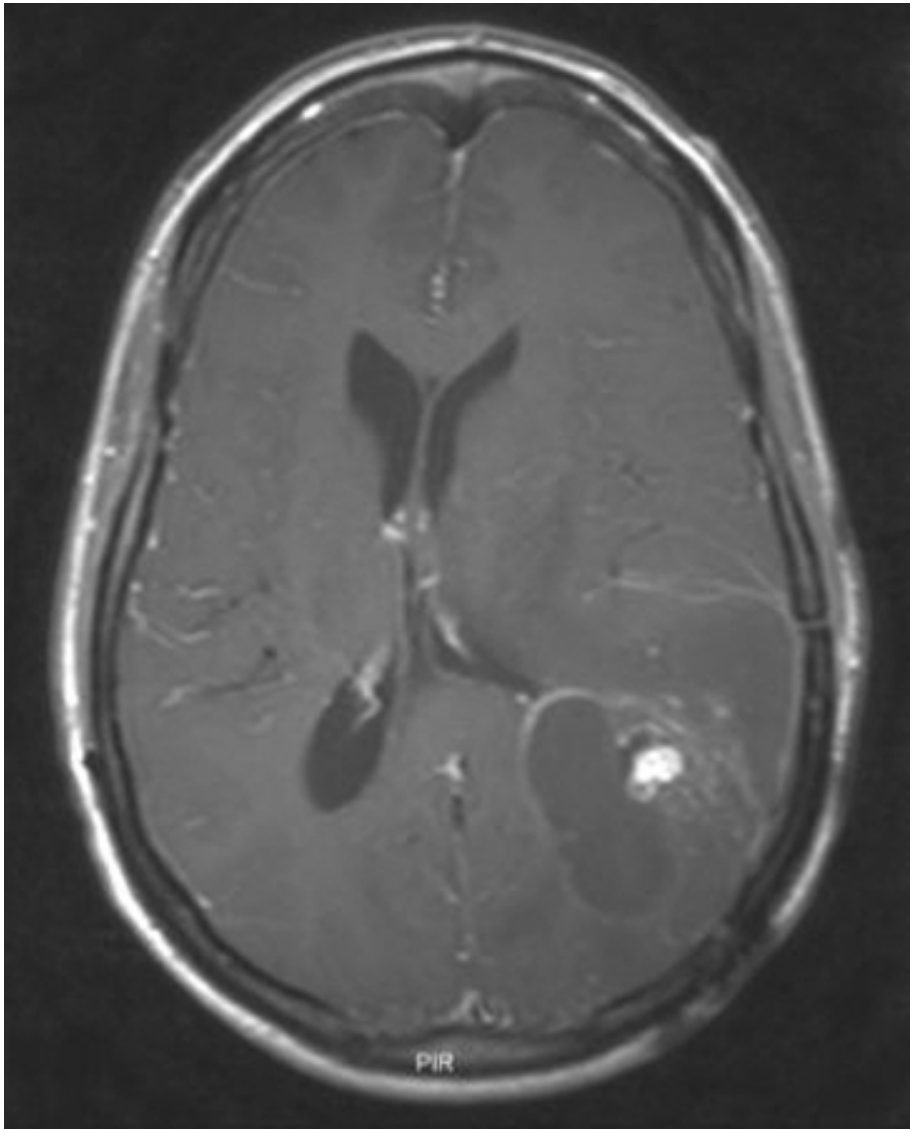

Pituitary tumor
Optic chiasm
Hypothalamus
Pituitary stalk
Anterior pituitary gland
Posterior pituitary gland
Sphenoid sinus
Sella turcica

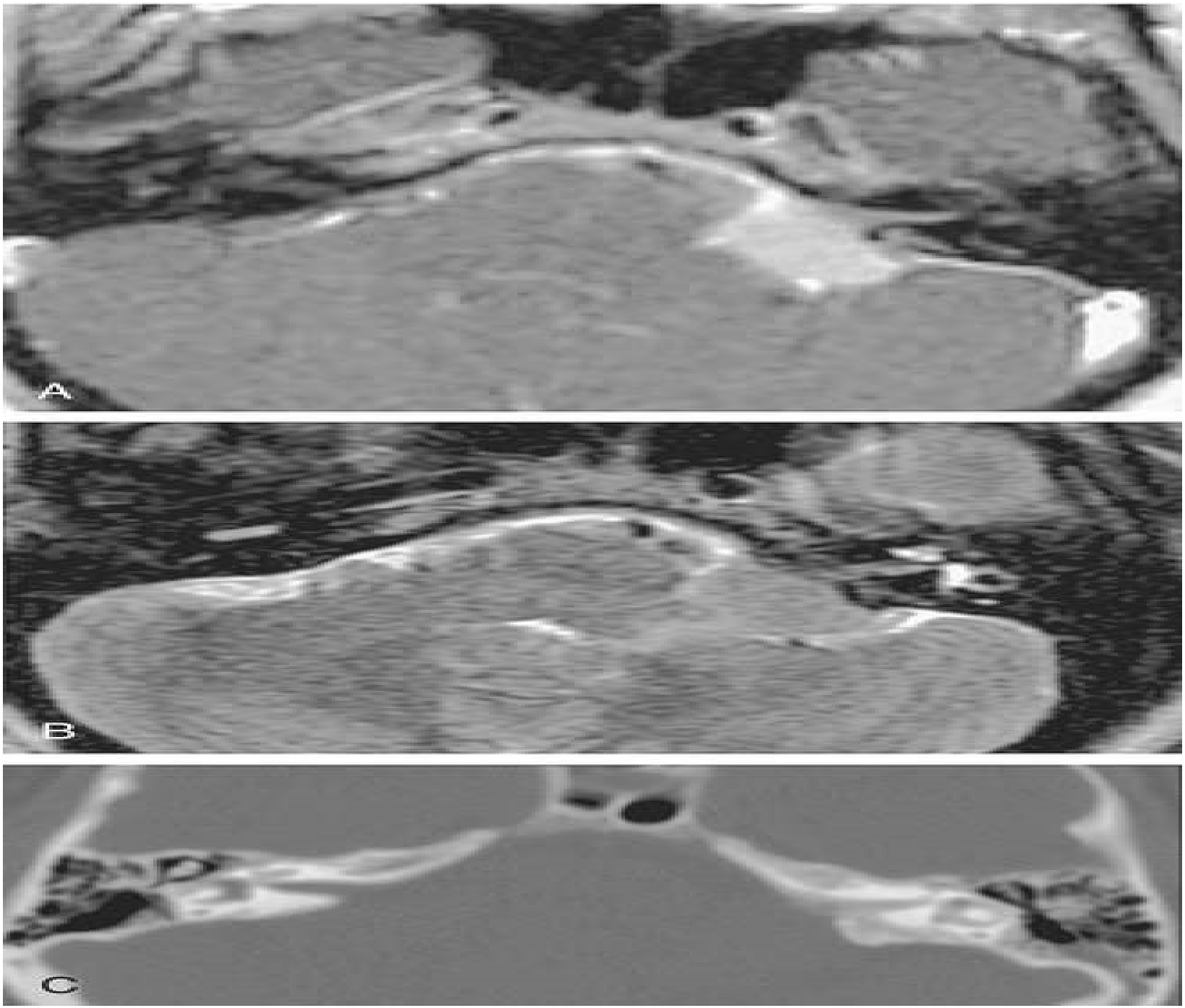


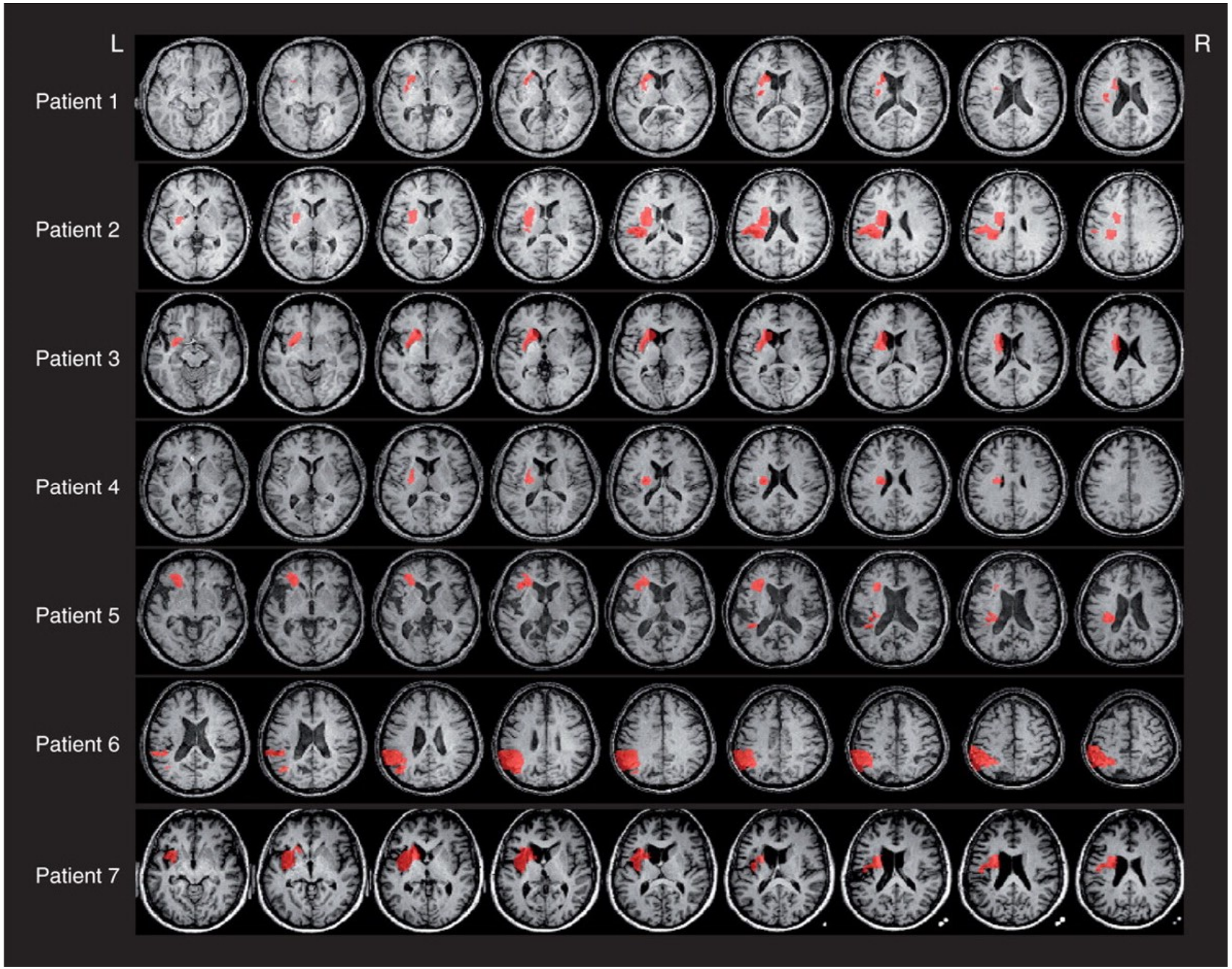

Posterior Transcallosal
Supratentorial-Suboccipital
(Occipital-Transtentorial)
Tumor
Infratentorial-Supracerebellar

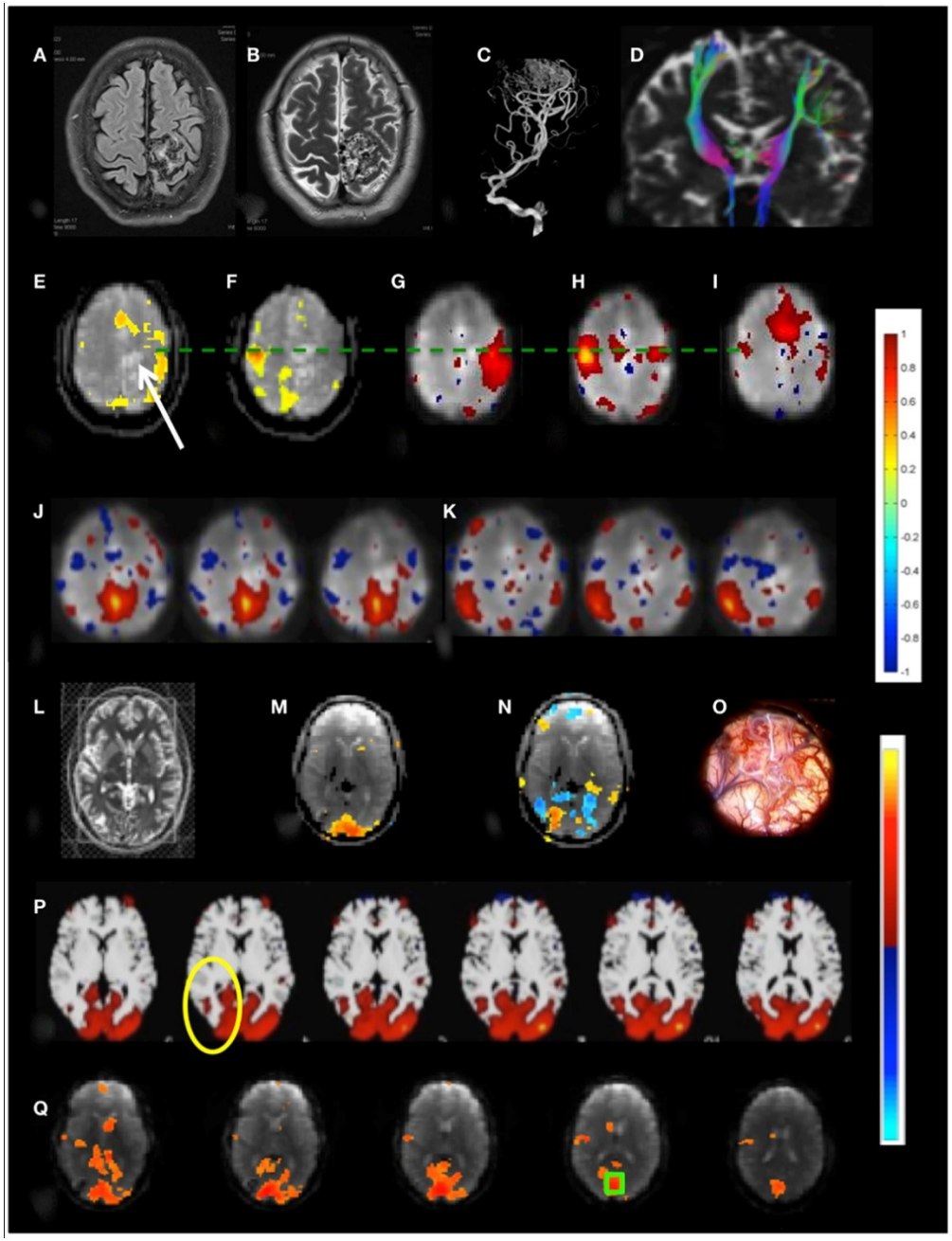

T1
Weighted
T2
Weighted
PD
Weighted

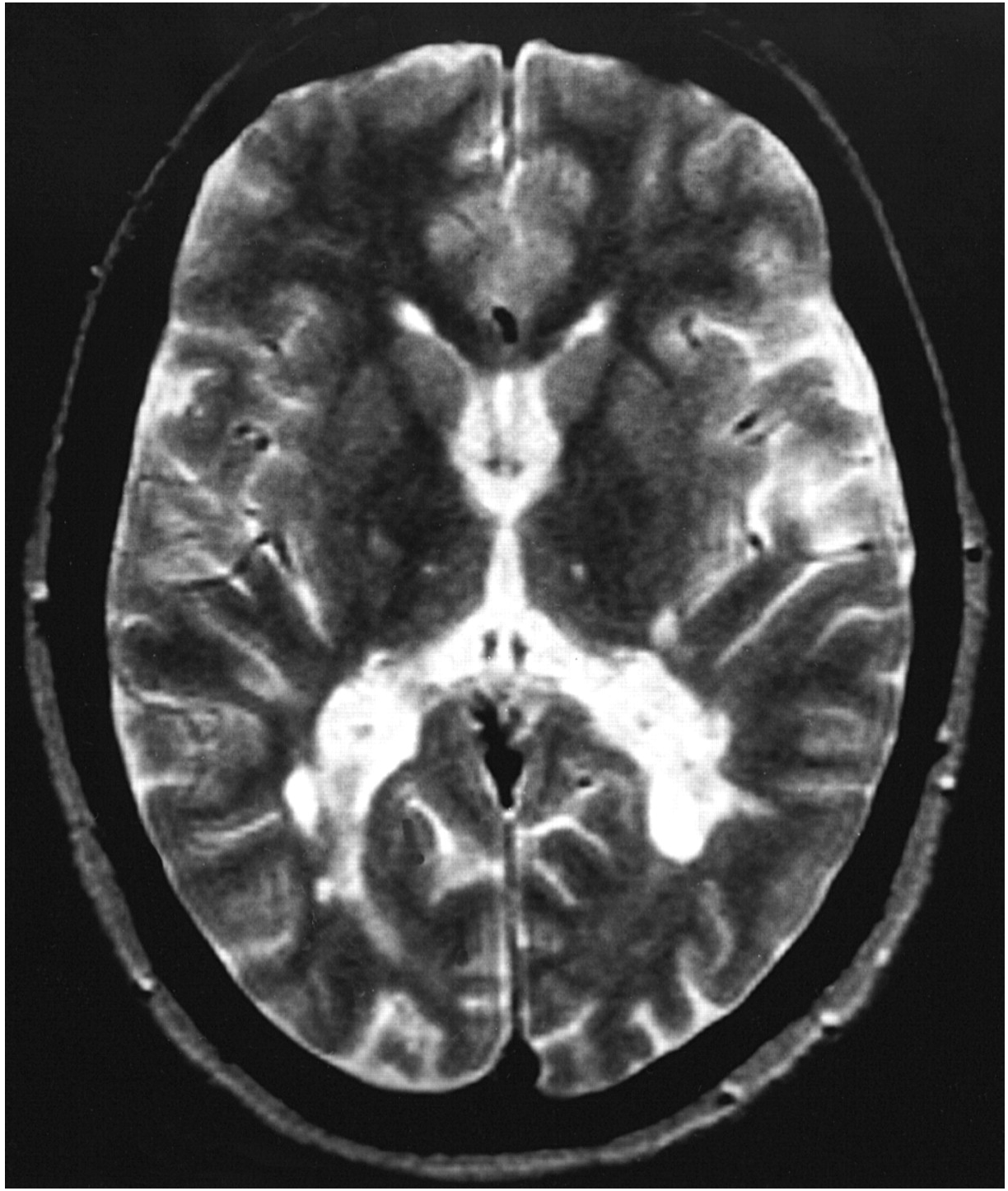

(c)
(d)

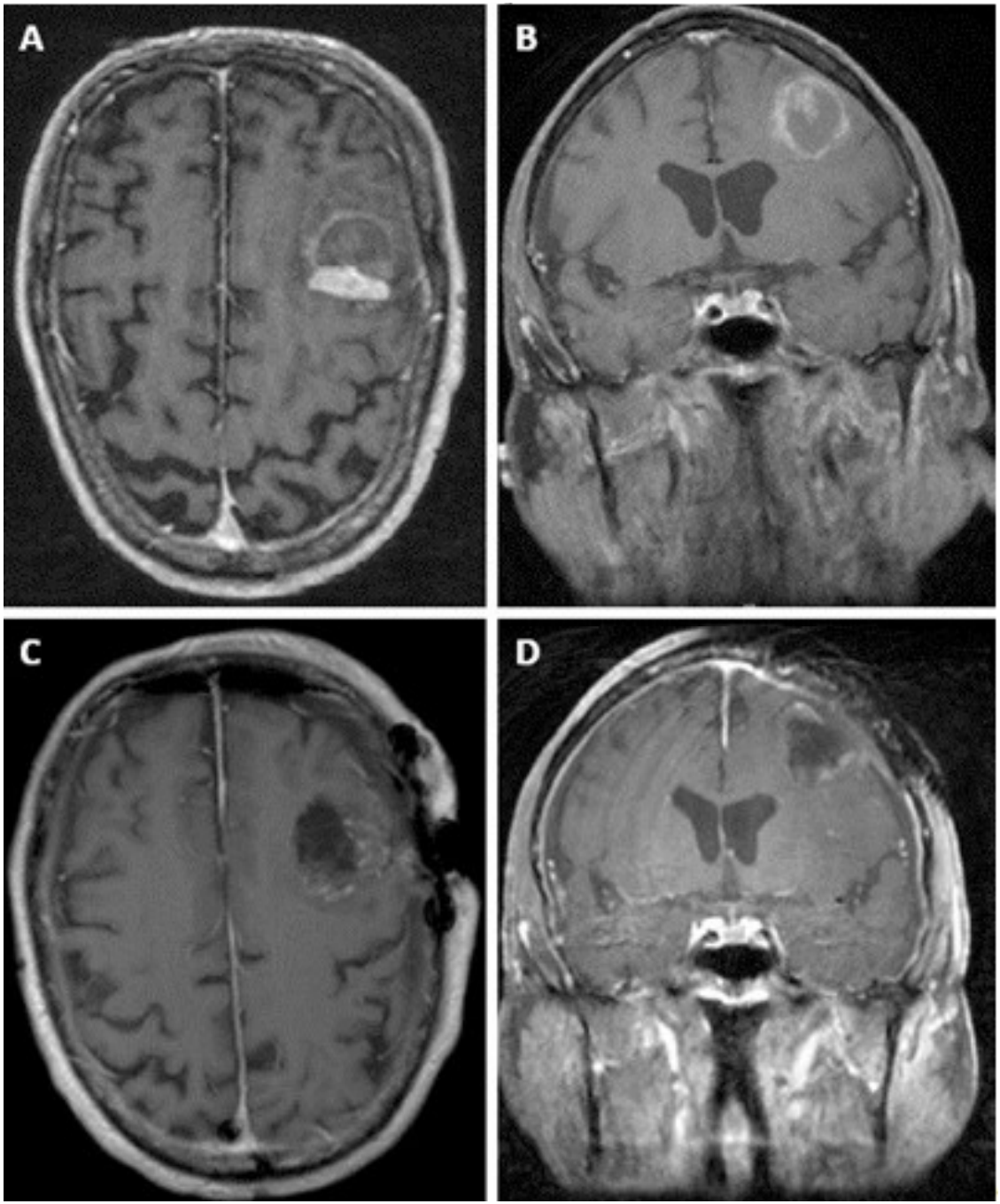

PIR

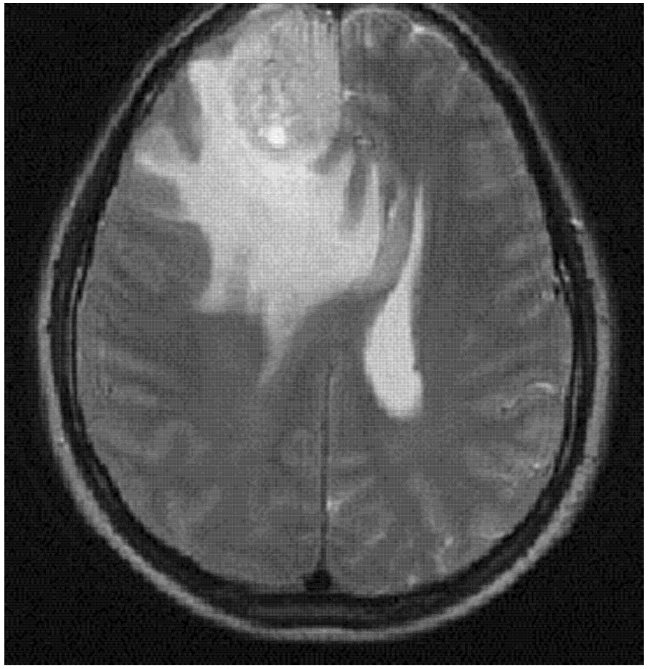

A
B
C


L
R
Patient 1
Patient 2
Patient 3
Patient 4
Patient 5
Patient 6
Patient 7

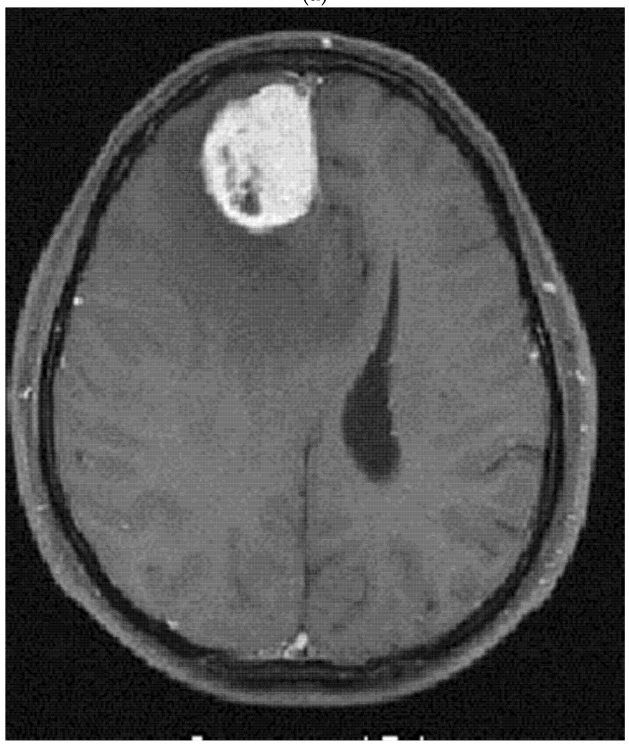

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1



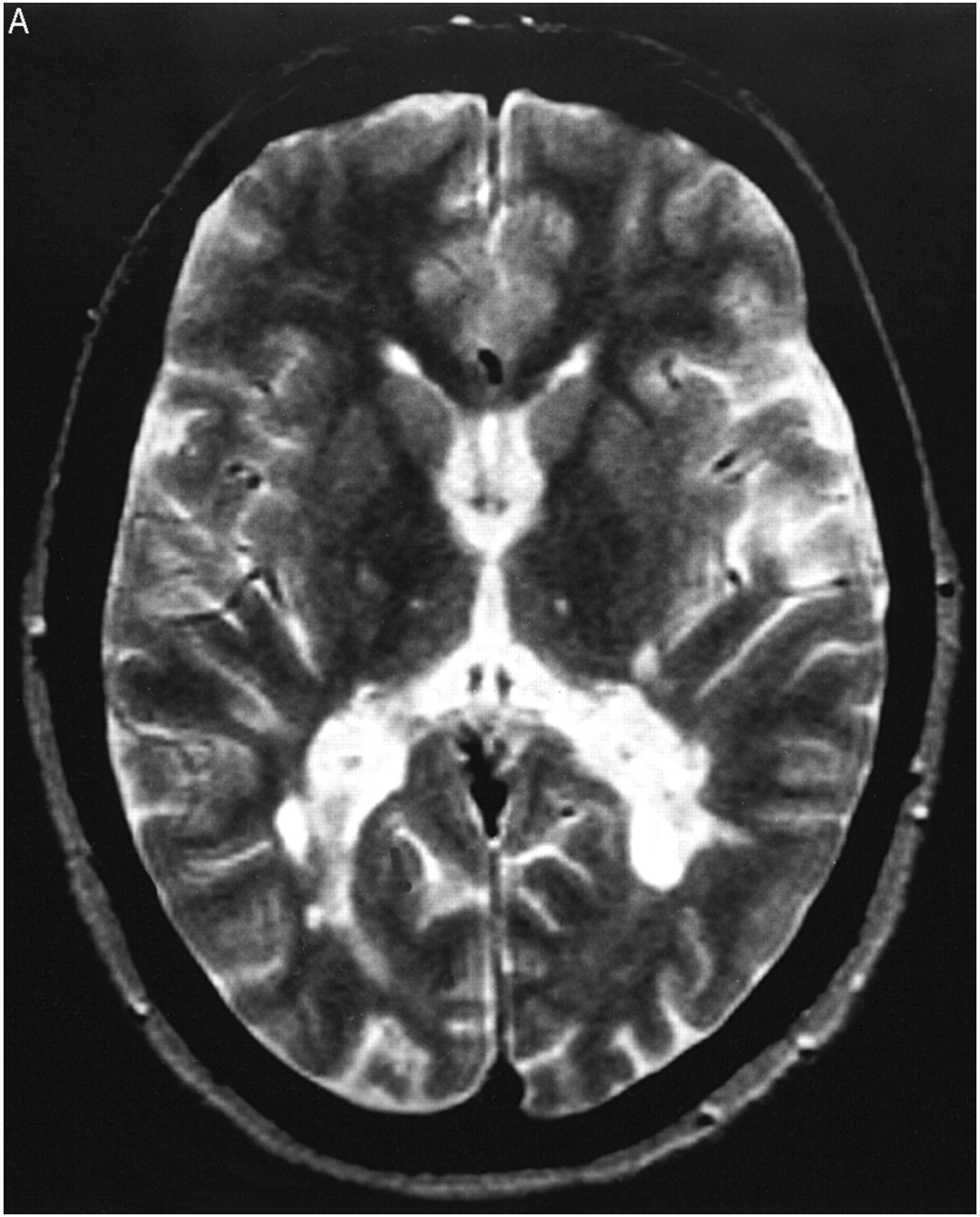

A
B
C
D

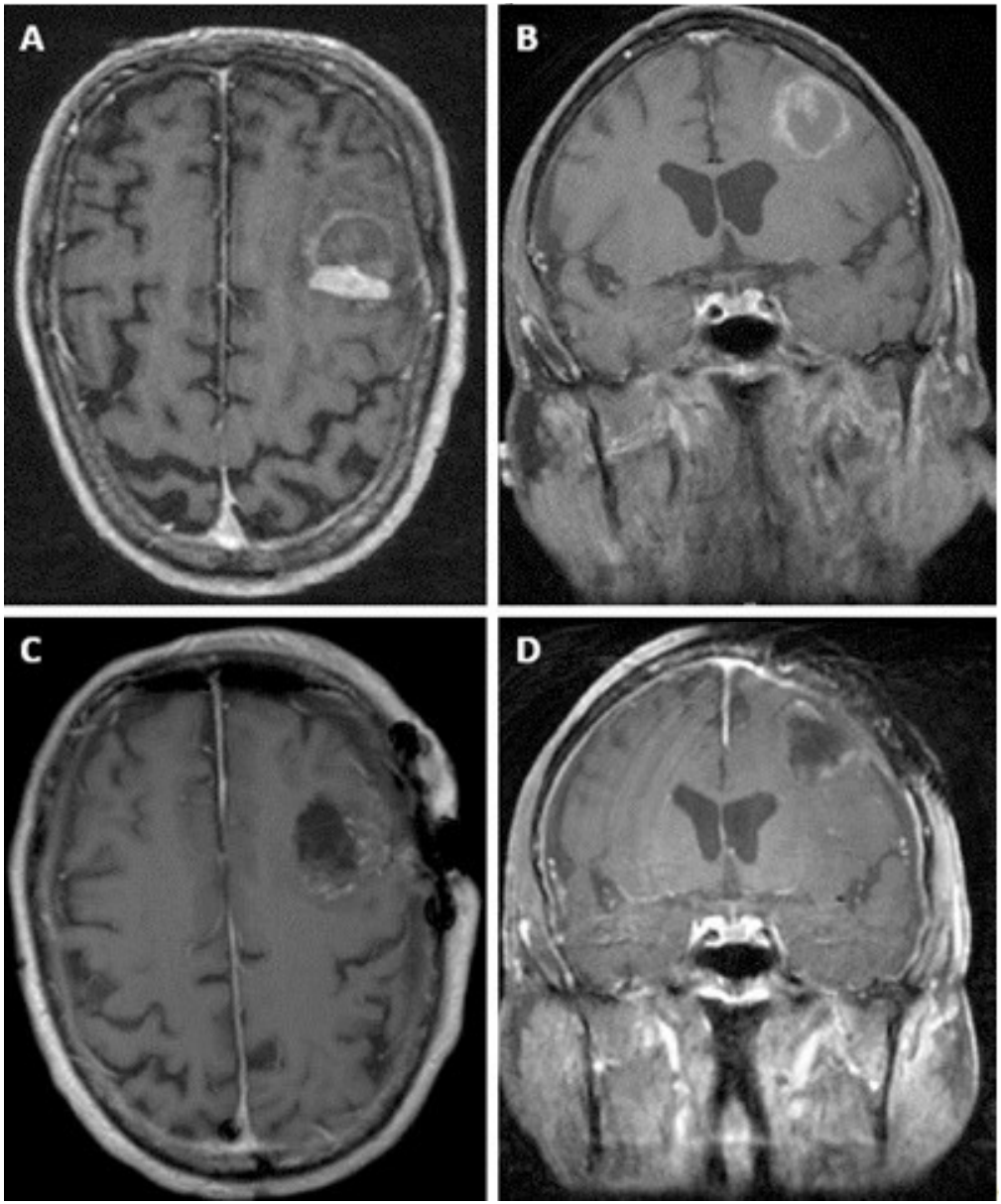


(a)



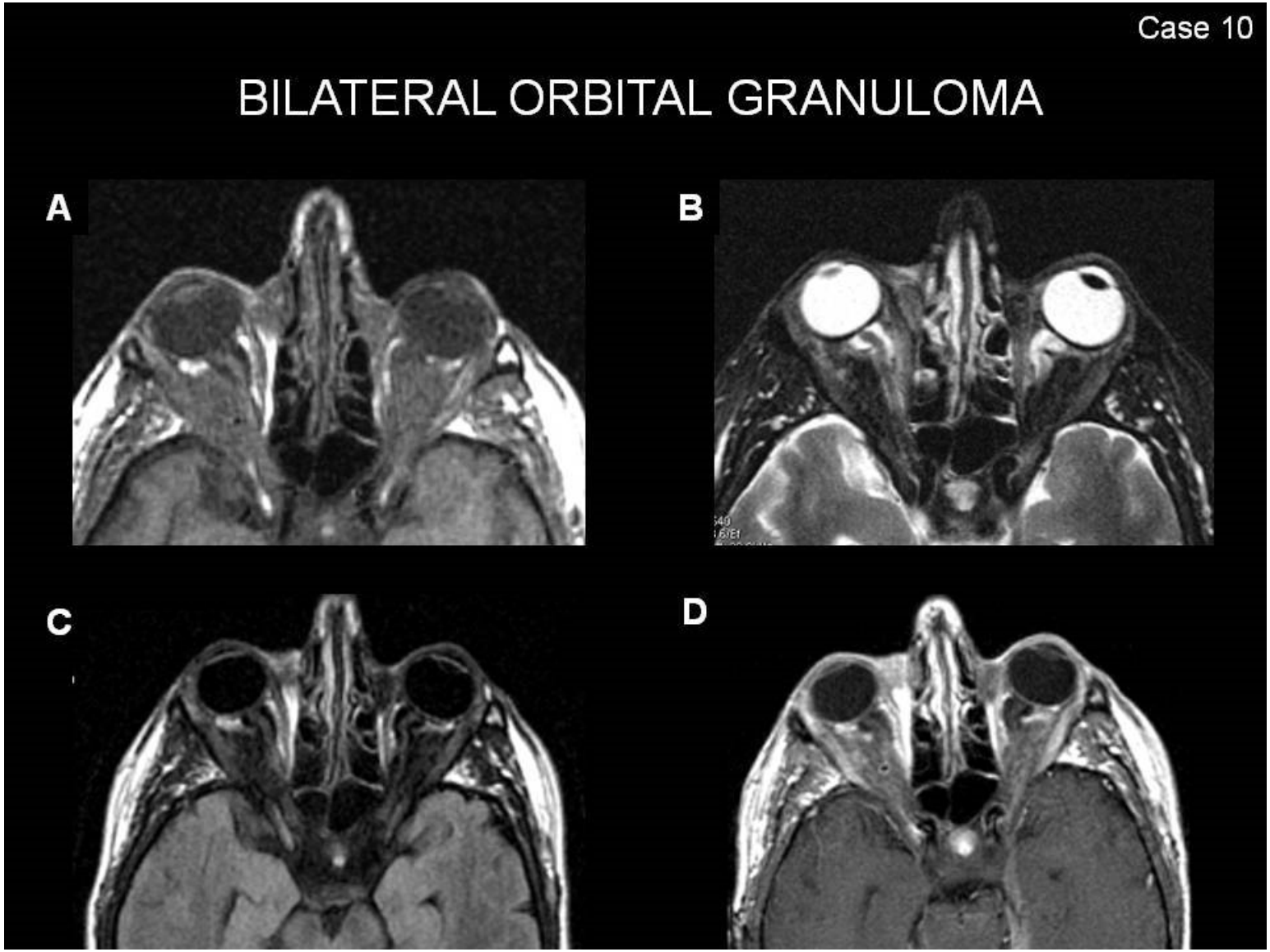
(b)

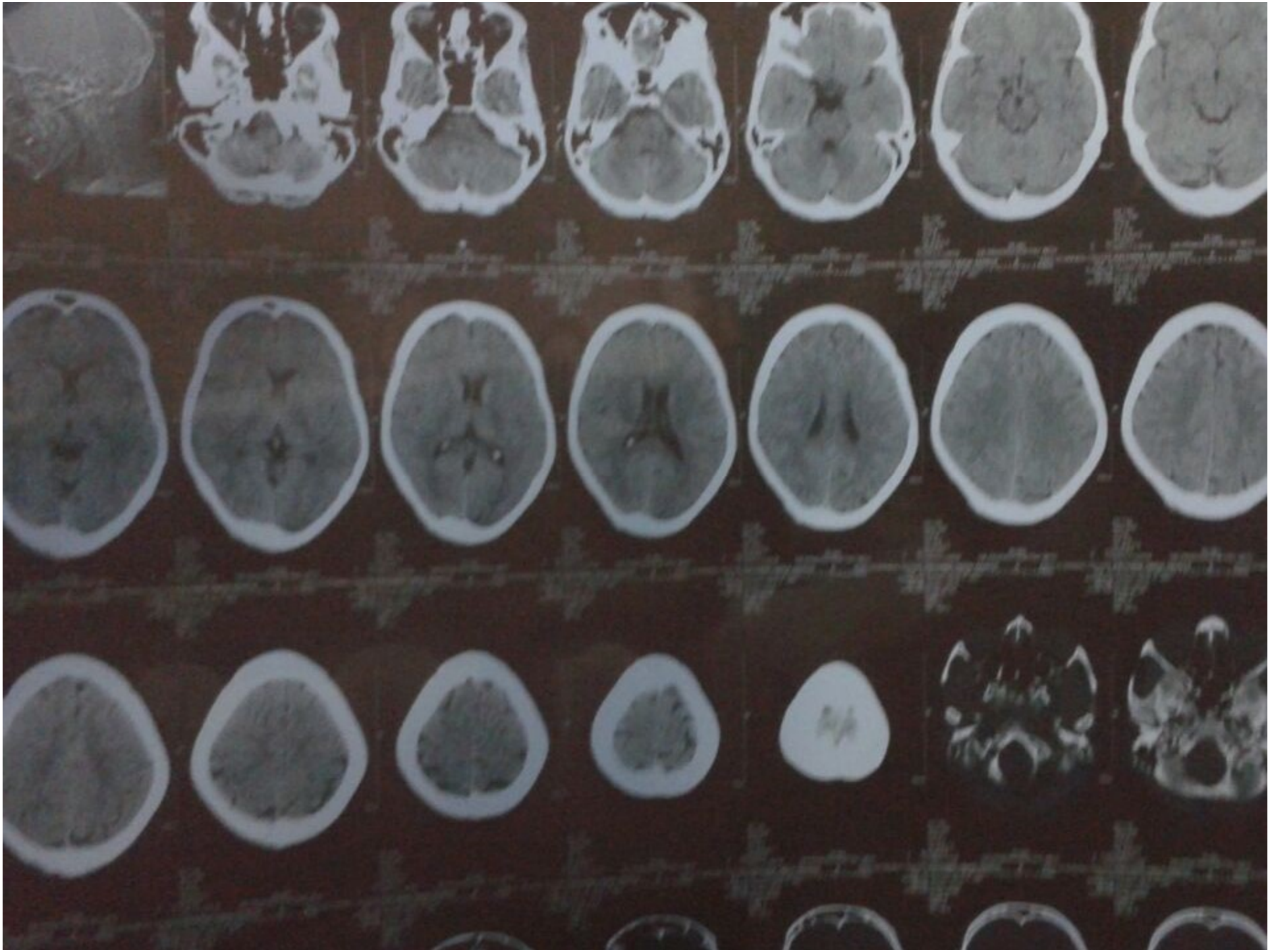

A

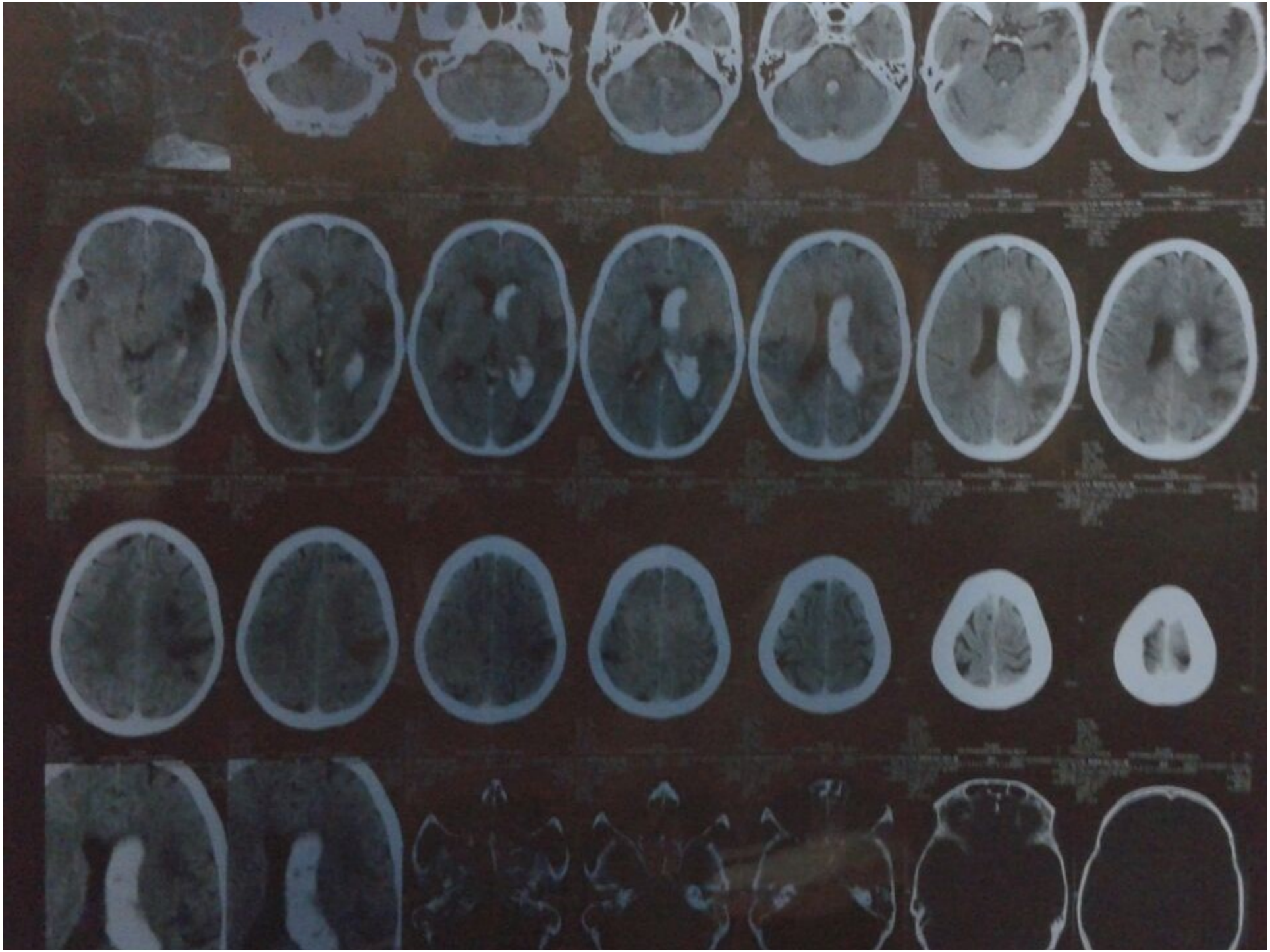

A
B
C
D

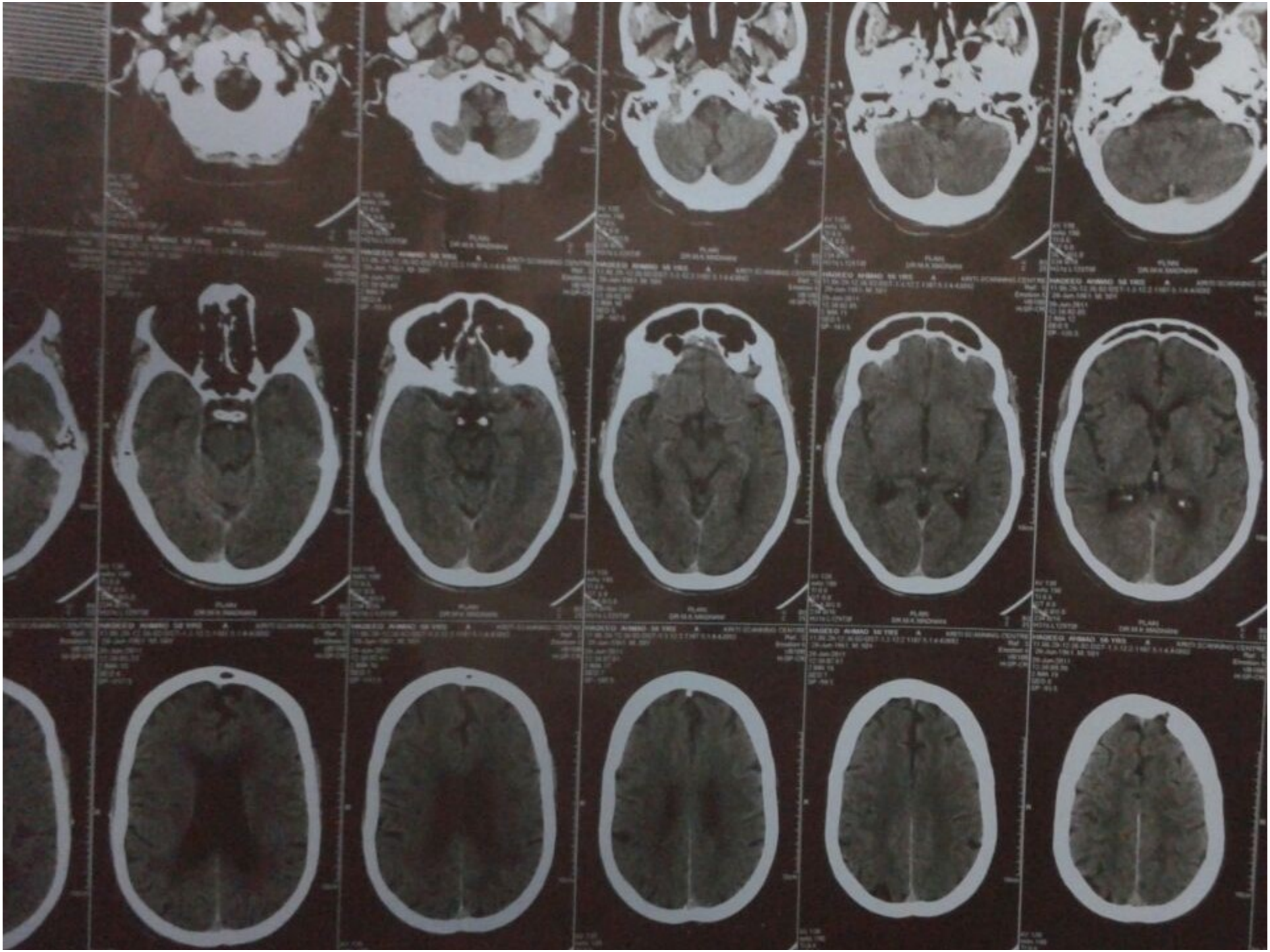
Case 10

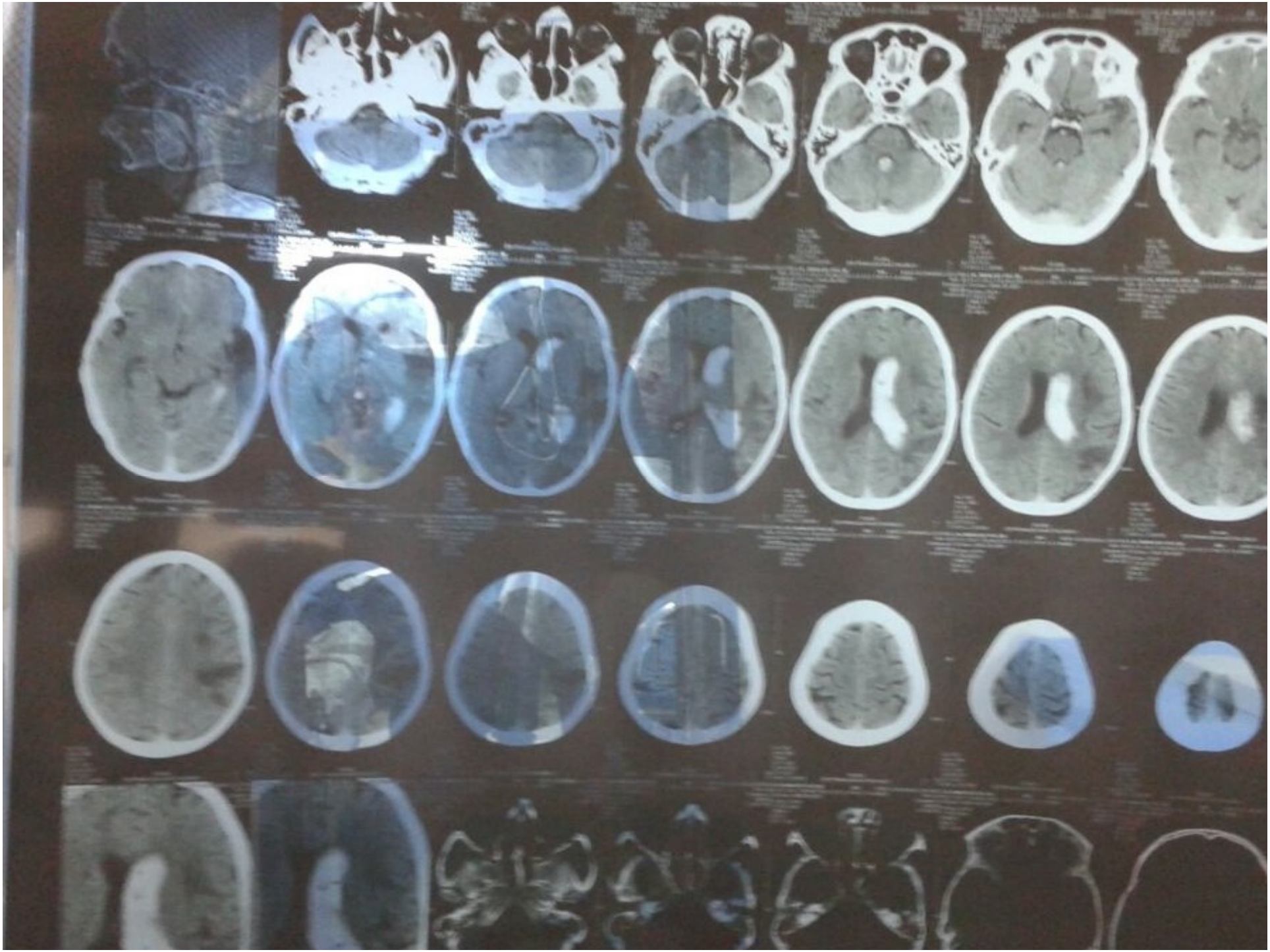
BILATERAL ORBITAL GRANULOMA

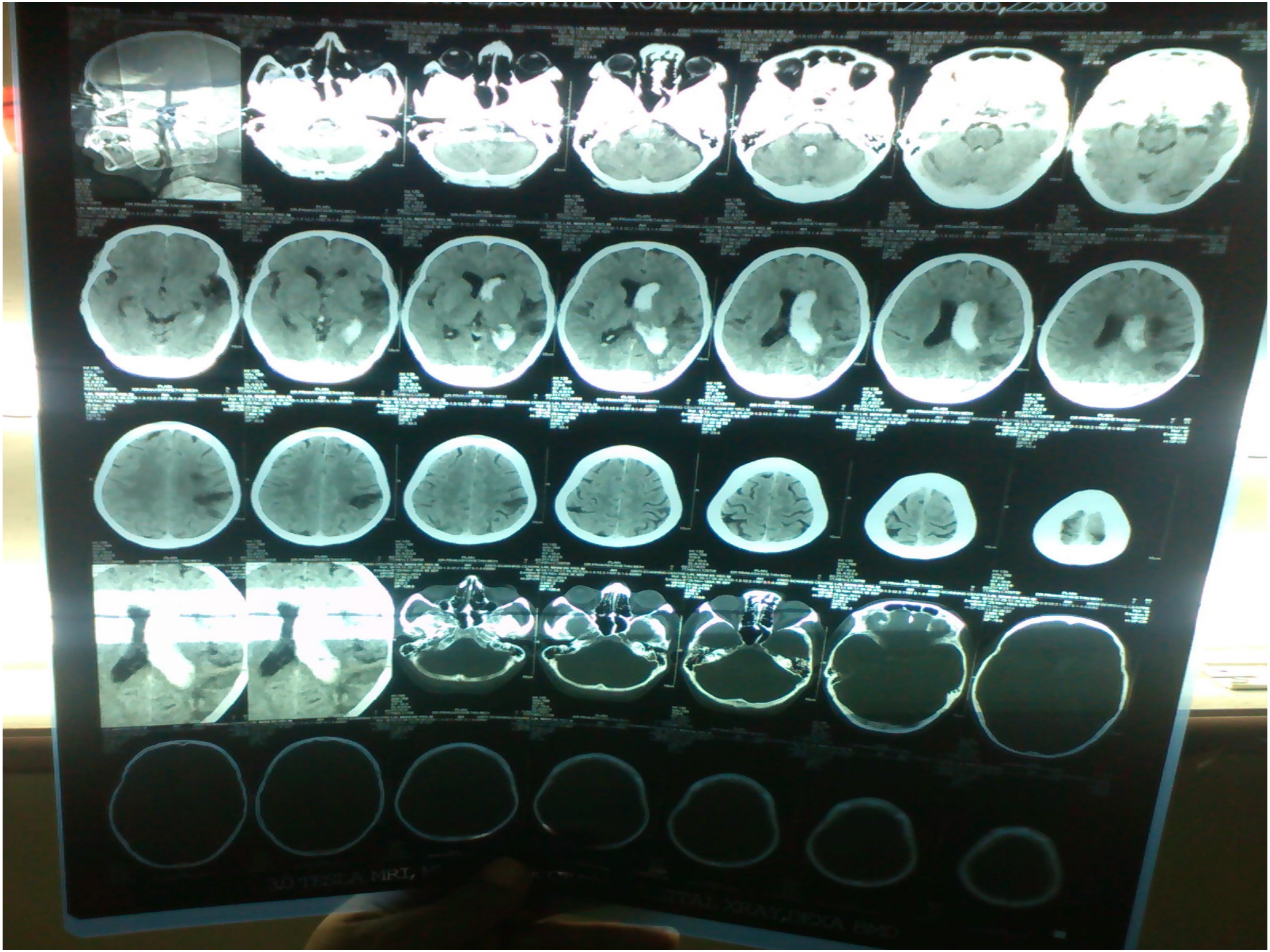


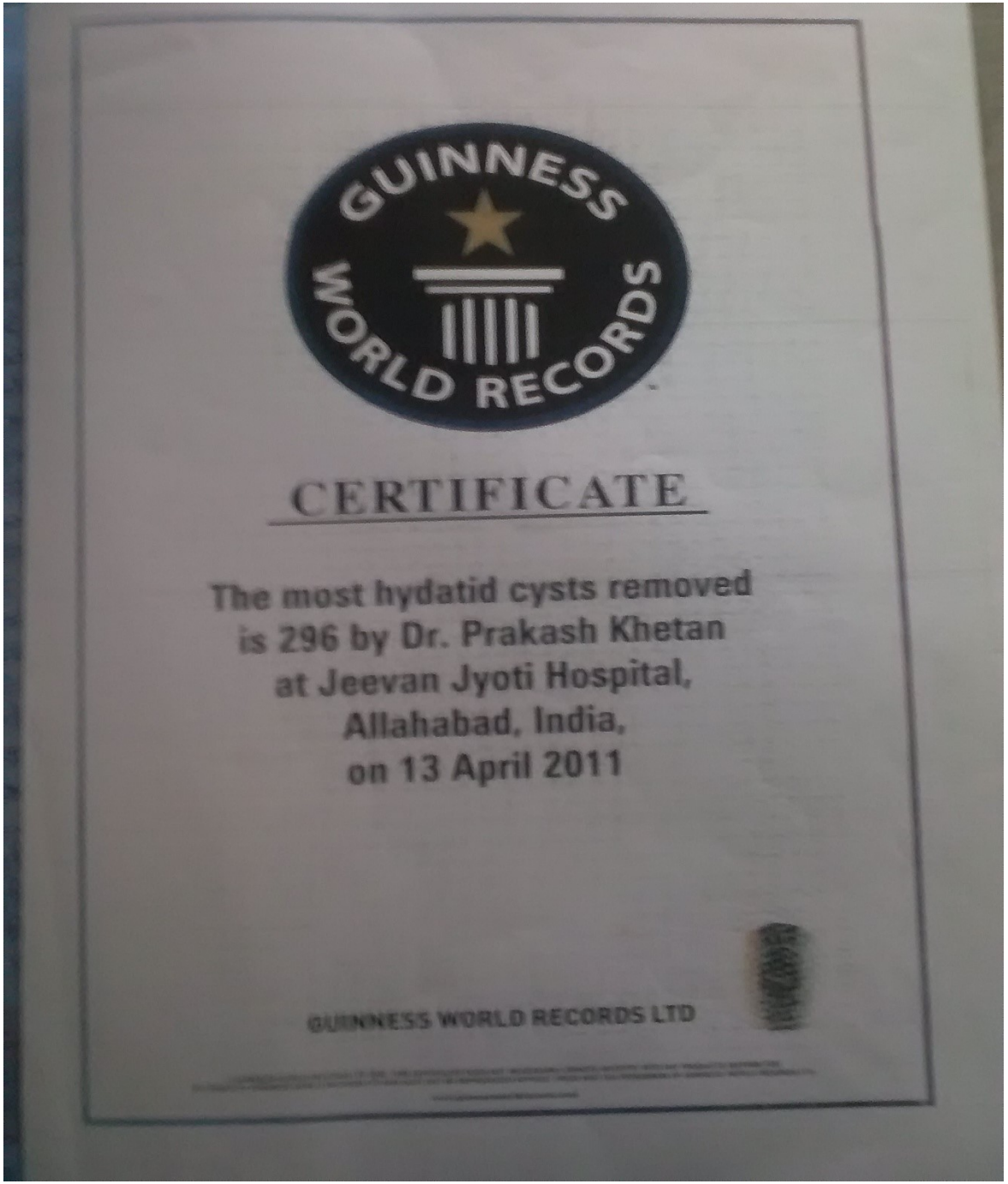











GUINNESS
WORLD RECORDS
CERTIFICATE
The most hydatid cysts removed
is 296 by Dr. Prakash Khetan
at Jeevan Jyoti Hospital,
Allahabad, India,
on 13 April 2011
GUINNESS WORLD RECORDS LTD

Limca
Book of Records

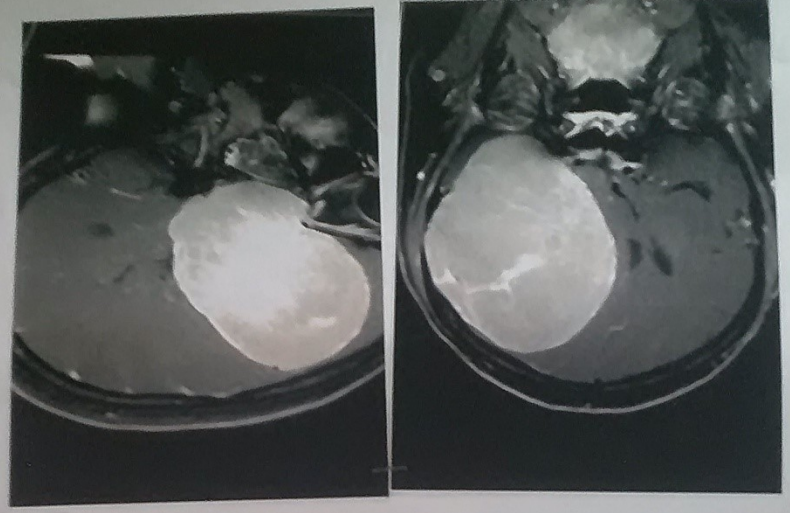
National Record 2012

A team of doctors led by neurosurgeon **Dr Prakash Khetan** at Jeevan Jyothi Hospital, Allahabad removed the most hydatid cysts (296) from the brain of eight-year-old Reshma of Banda district in Uttar Pradesh during an eight-hour operation on April 13, 2011.

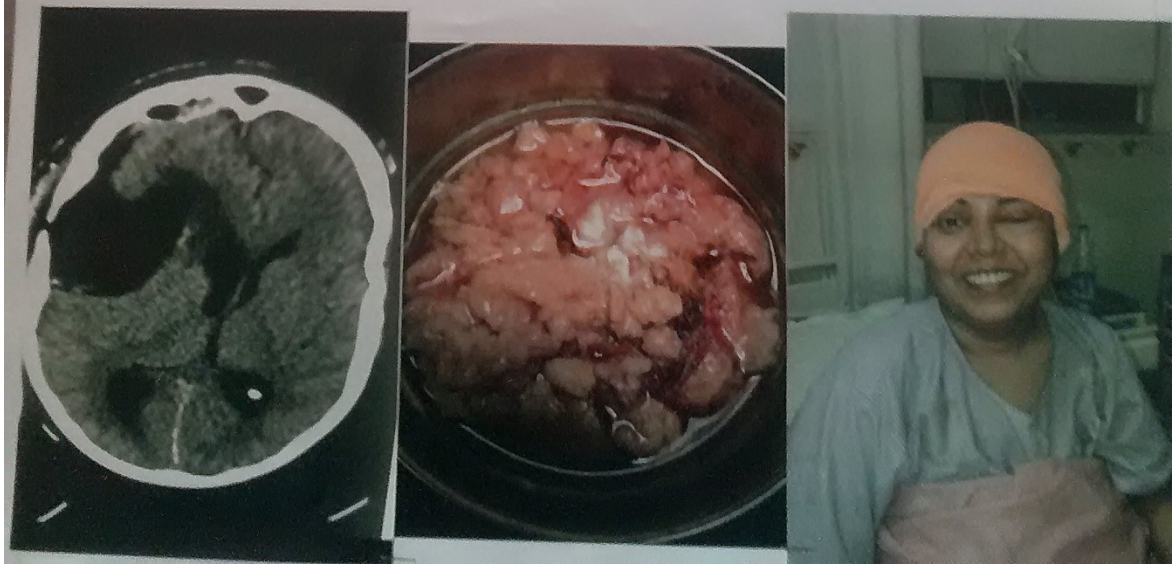
Vijaya Ghose

Vijaya Ghose
Editor, Limca Book of Records

आपरेशन से पहले



आपरेशन के बाद




ASIA
BOOK OF
RECORDS
www.asiabookofrecords.com
CERTIFICATE
Dr. Prakash Khetan (born on November 15, 1972), Lead Neurosurgeon, Guru Kripa Jagrati Hospital, Allahabad, performed a successful surgery of massive brain tumor (240 grms) of 35 year old lady 'Savita Agarwal, on December 1, 2013. The patient is enjoying her normal life.
Date: March 4, 2014

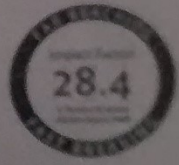
THE LANCET

Reprint

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

CRASH-2 trial collaborators

Lancet 2010; 376: 23–32



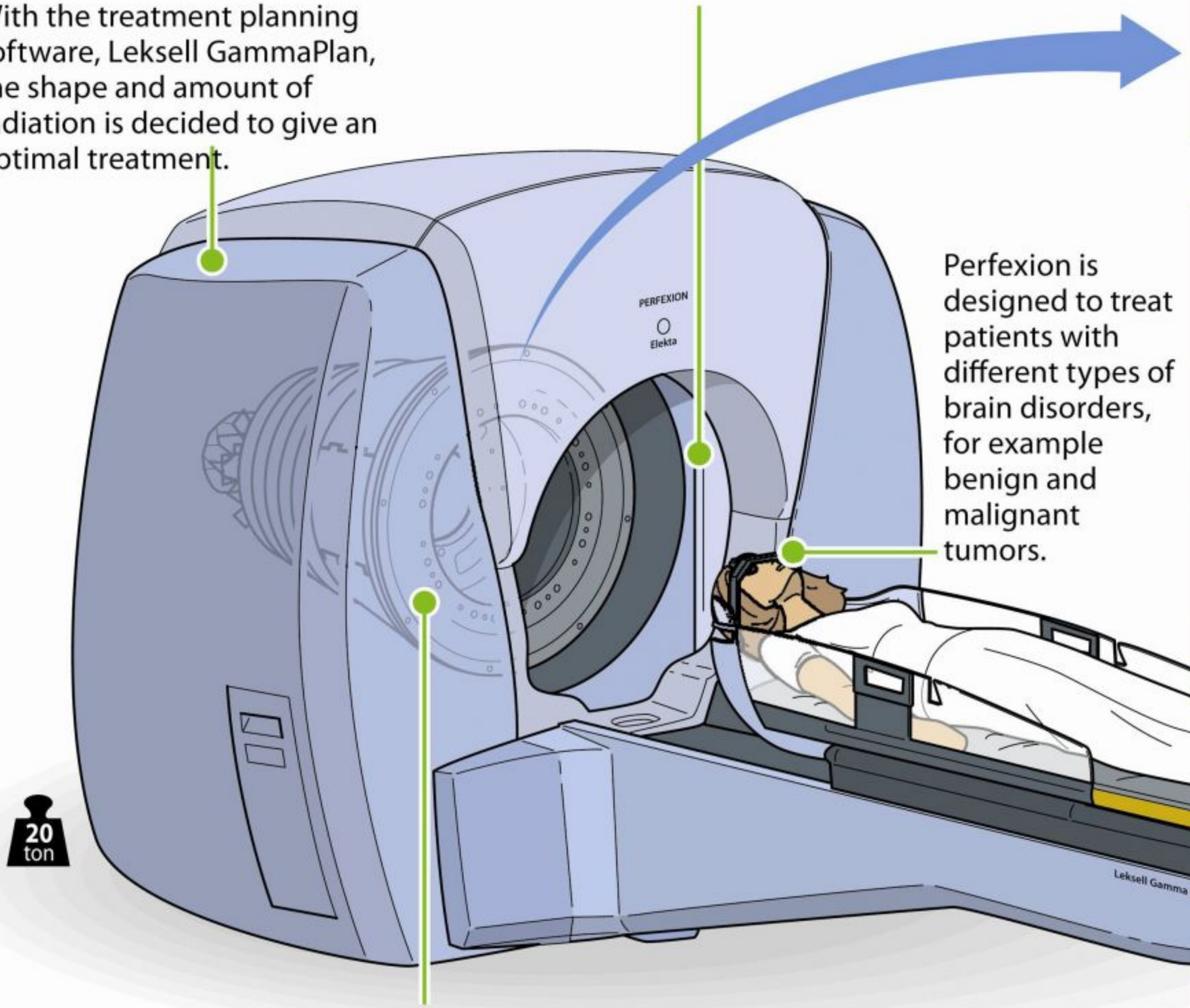
Thank You

Leksell Gamma Knife Perfexion

Treats brain disorders with a high dose of radiation delivered with surgical precision.

The patient can communicate via video camera and an intercom at all times. The treatment time varies between 20 minutes and several hours depending on the complexity of the treatment.

With the treatment planning software, Leksell GammaPlan, the shape and amount of radiation is decided to give an optimal treatment.

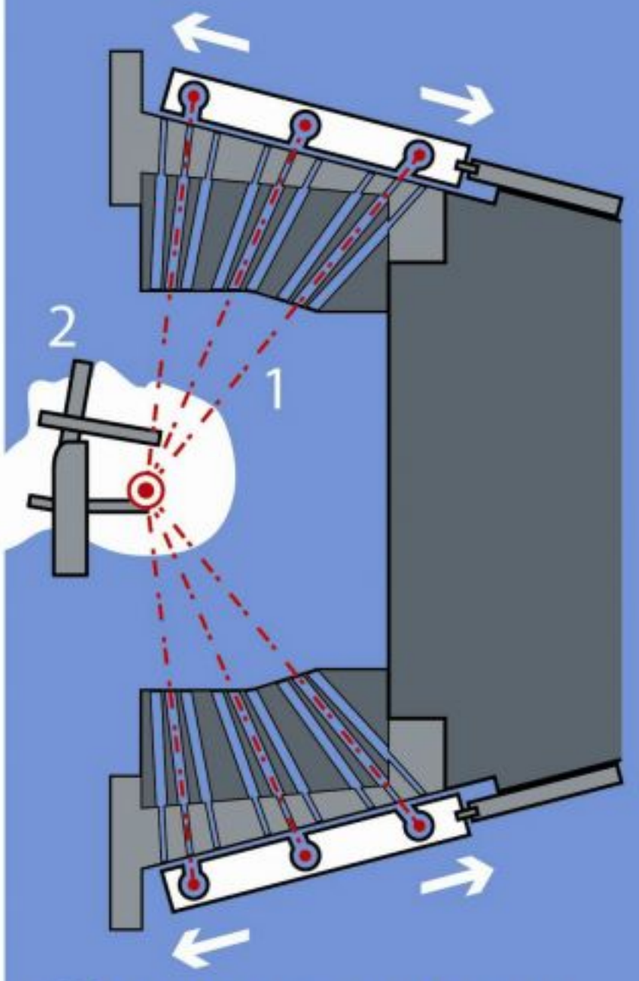


Perfexion is designed to treat patients with different types of brain disorders, for example benign and malignant tumors.

Leksell Gamma Knife Perfexion is fully automated. The radiation unit is housed inside of the machine itself. The radiation beams are shaped exactly around the tumor. Several tumors can be treated in one session.

Radiation unit

1 Ionizing gamma radiation is emitted from 192 cobalt-60 sources whose beams converge on a precise selected area of the brain. The accuracy is about 0.5 mm. There is minimal effect on the surrounding healthy tissue.



2 A stereotactic frame is attached to the patients head and interlocked to the Gamma Knife unit. This to ensure maximum precision.