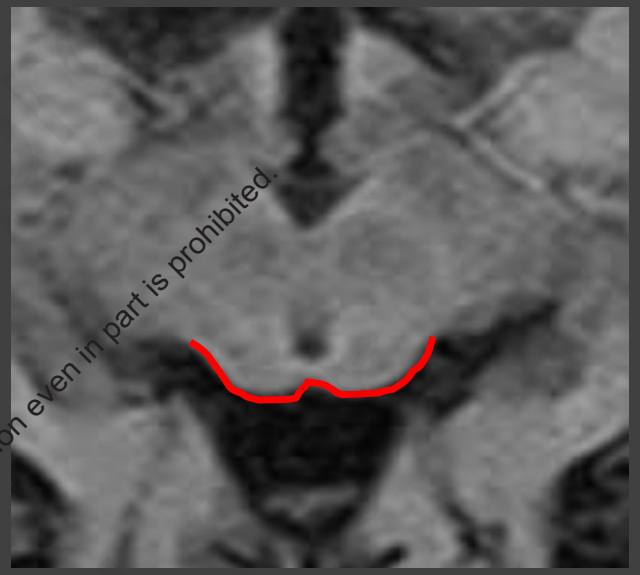
AVMs of the quadrigeminal plate



Georges Rodesch MD PhD

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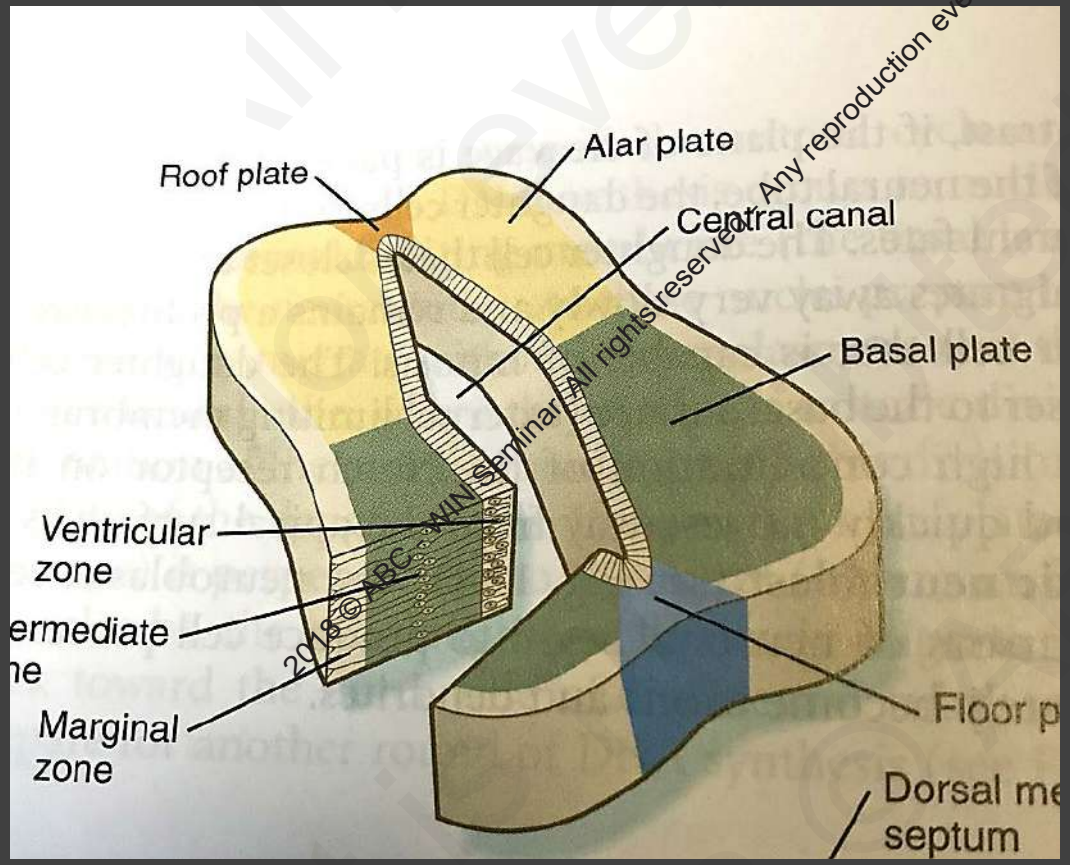
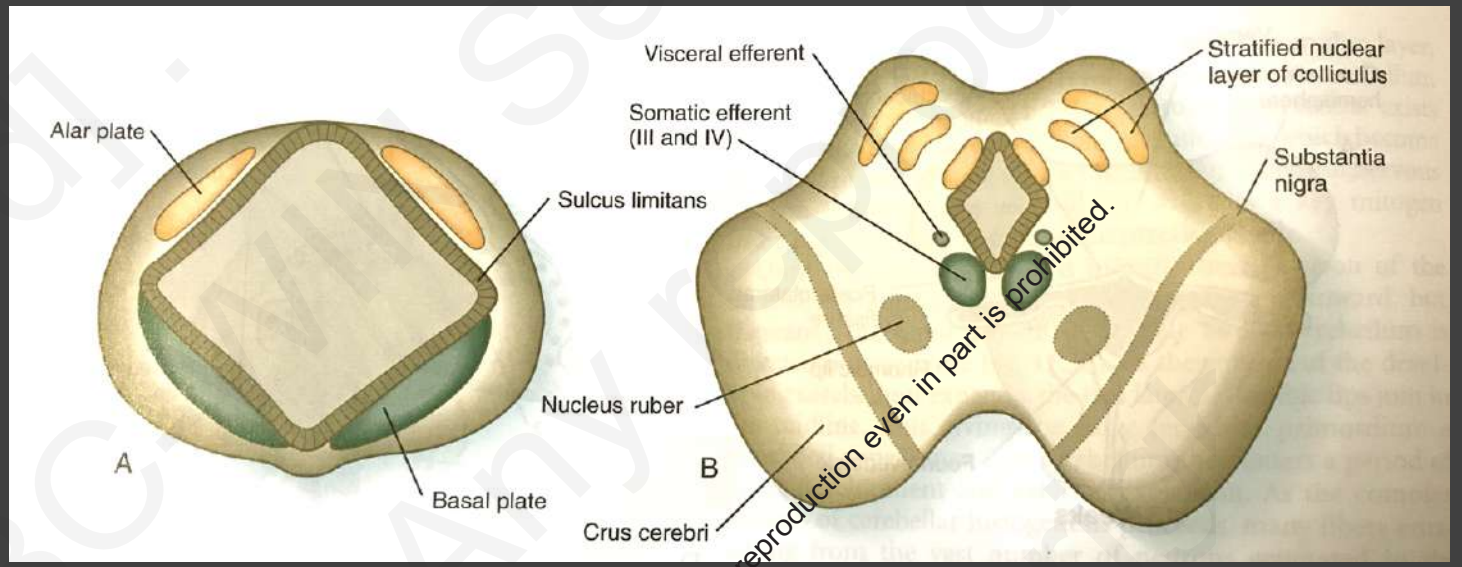
Hôpital Jean Lepoire, Nancy, France

No Conflict of Interest

Mesencephalon (midbrain) is structurally a relatively simple part of the brain in which the fundamental relationships between the basal and alar plates are preserved



B. Carlson
Human Embryology, 5th ed, Elsevier

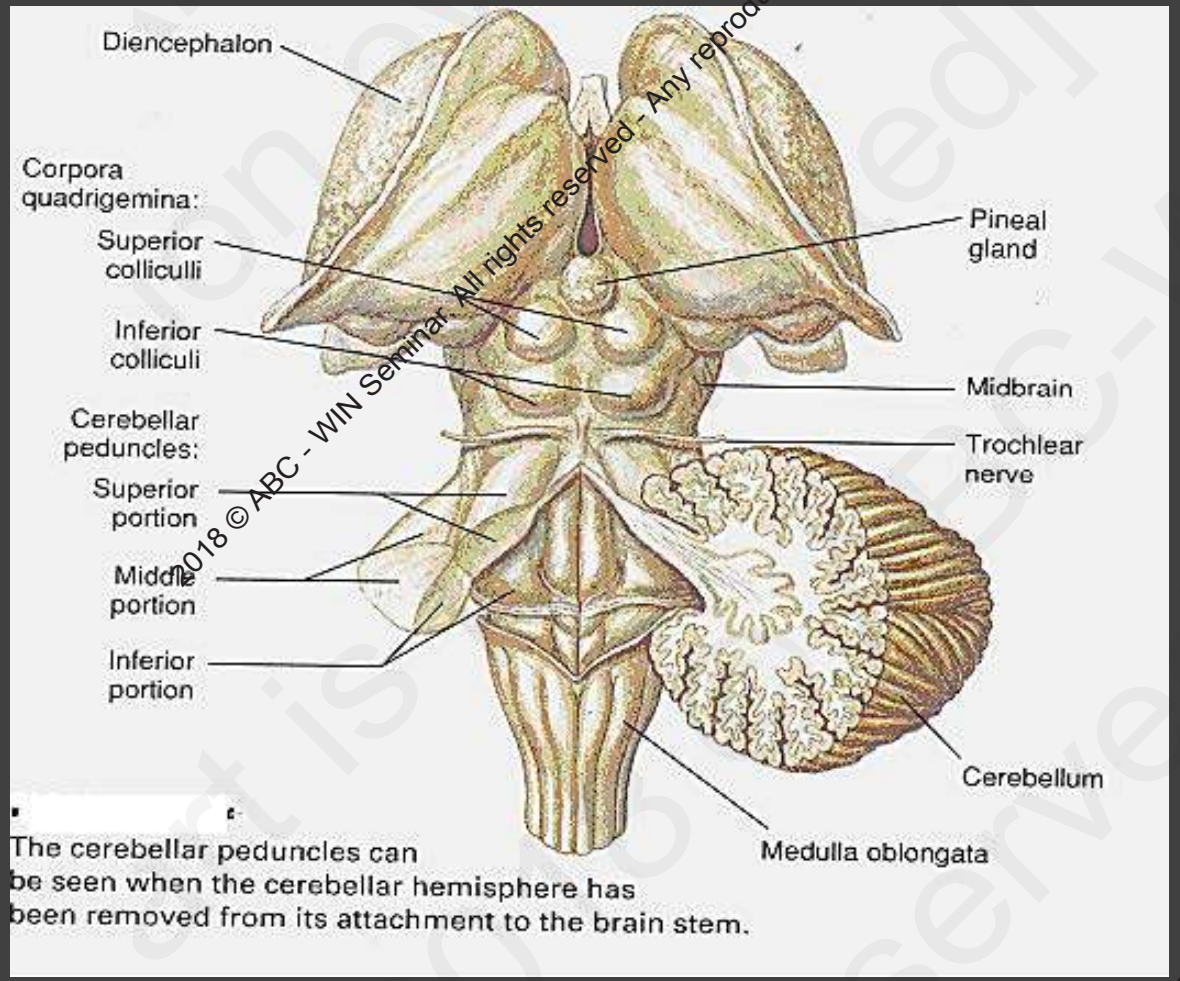


Basal plates form a neuron-rich area : the tegmentum
(location of the somatic efferent nuclei of cranial nerves III and IV)

Alar plates form sensory part of midbrain (tectum) which subserves functions of vision and hearing

In response to the localized expression of En-1 and Pax-7, neuroblasts migrating toward the roof form two prominent pair of bulges: *the corpora quadrigemina*

Tectal (quadrigeminal) plate is the portion of the midbrain tectum upon which the superior and inferior colliculi sit



The cerebellar peduncles can be seen when the cerebellar hemisphere has been removed from its attachment to the brain stem.

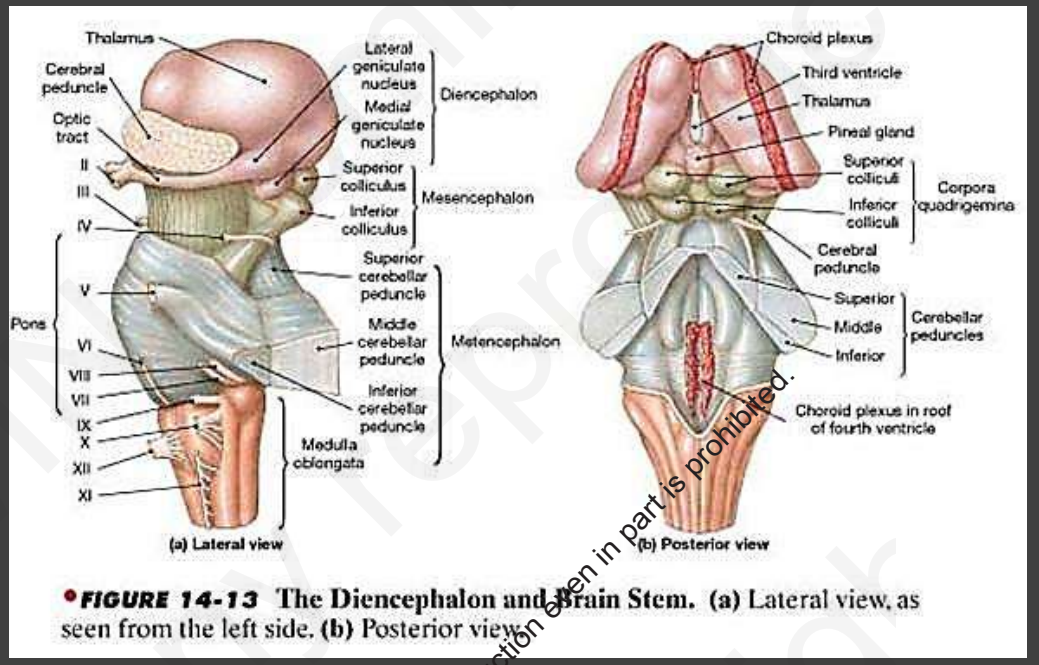
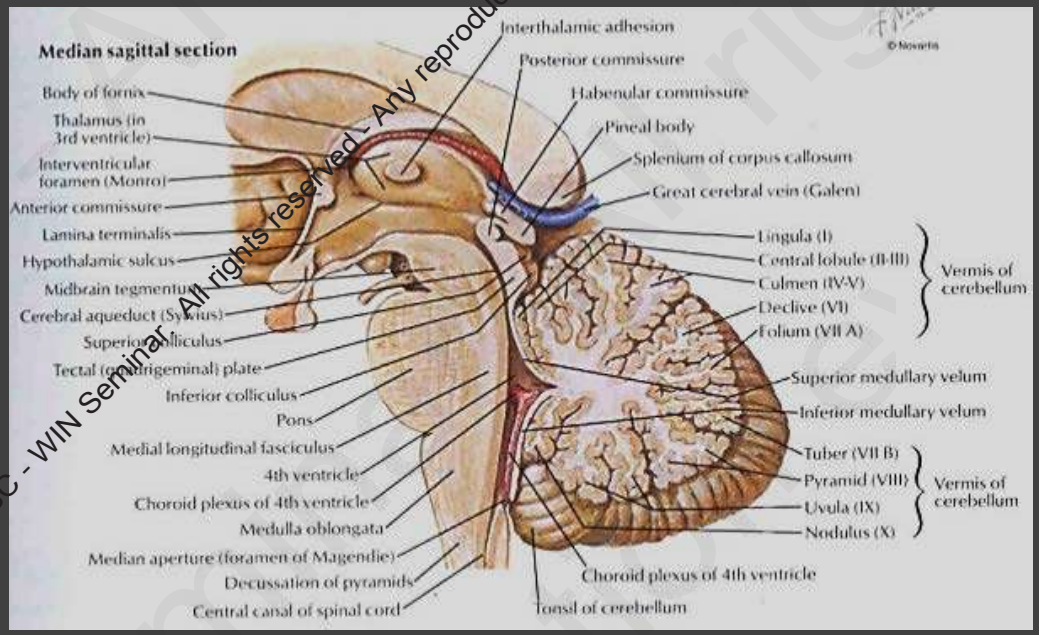
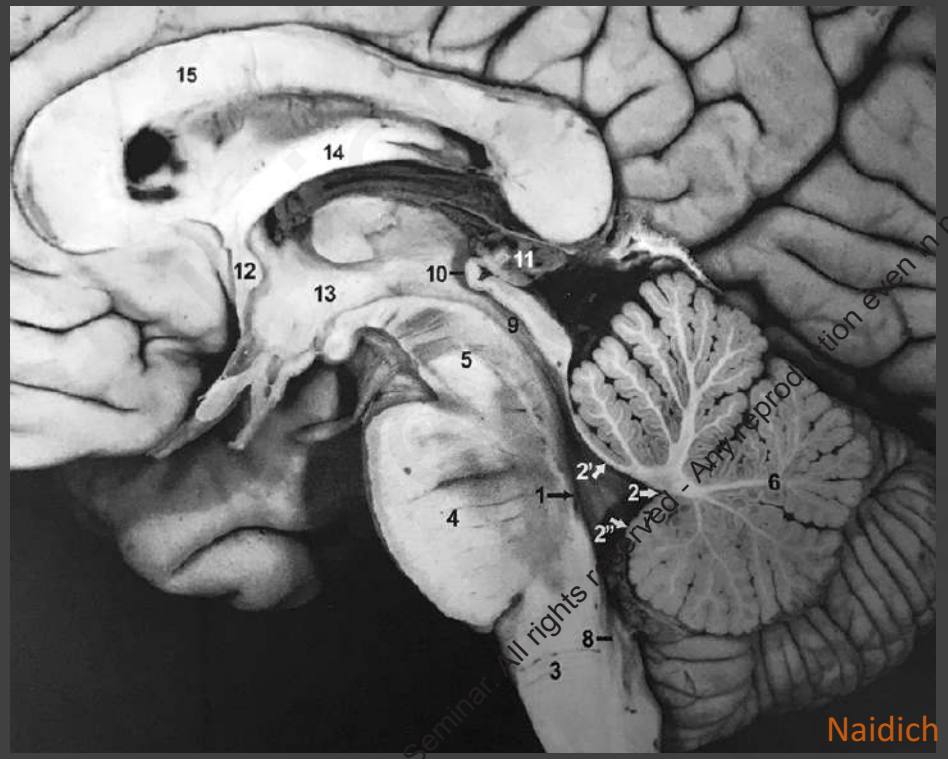
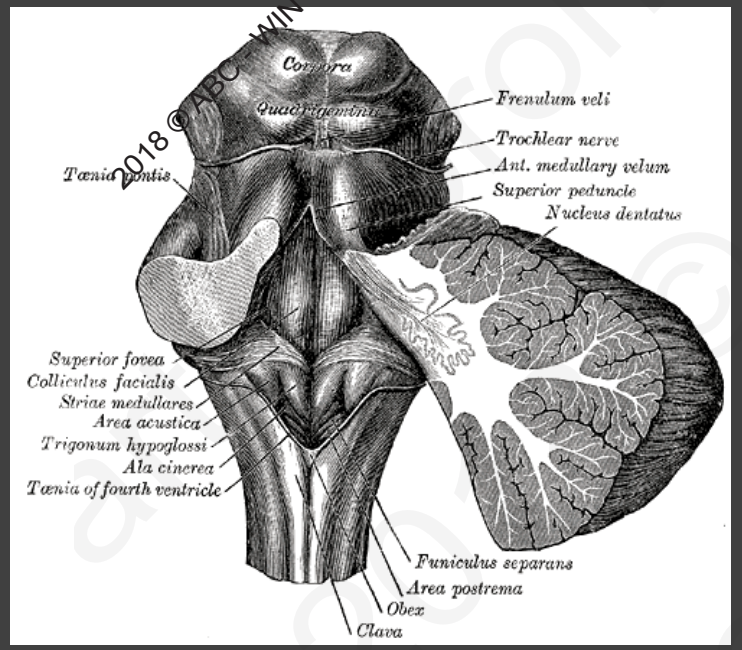


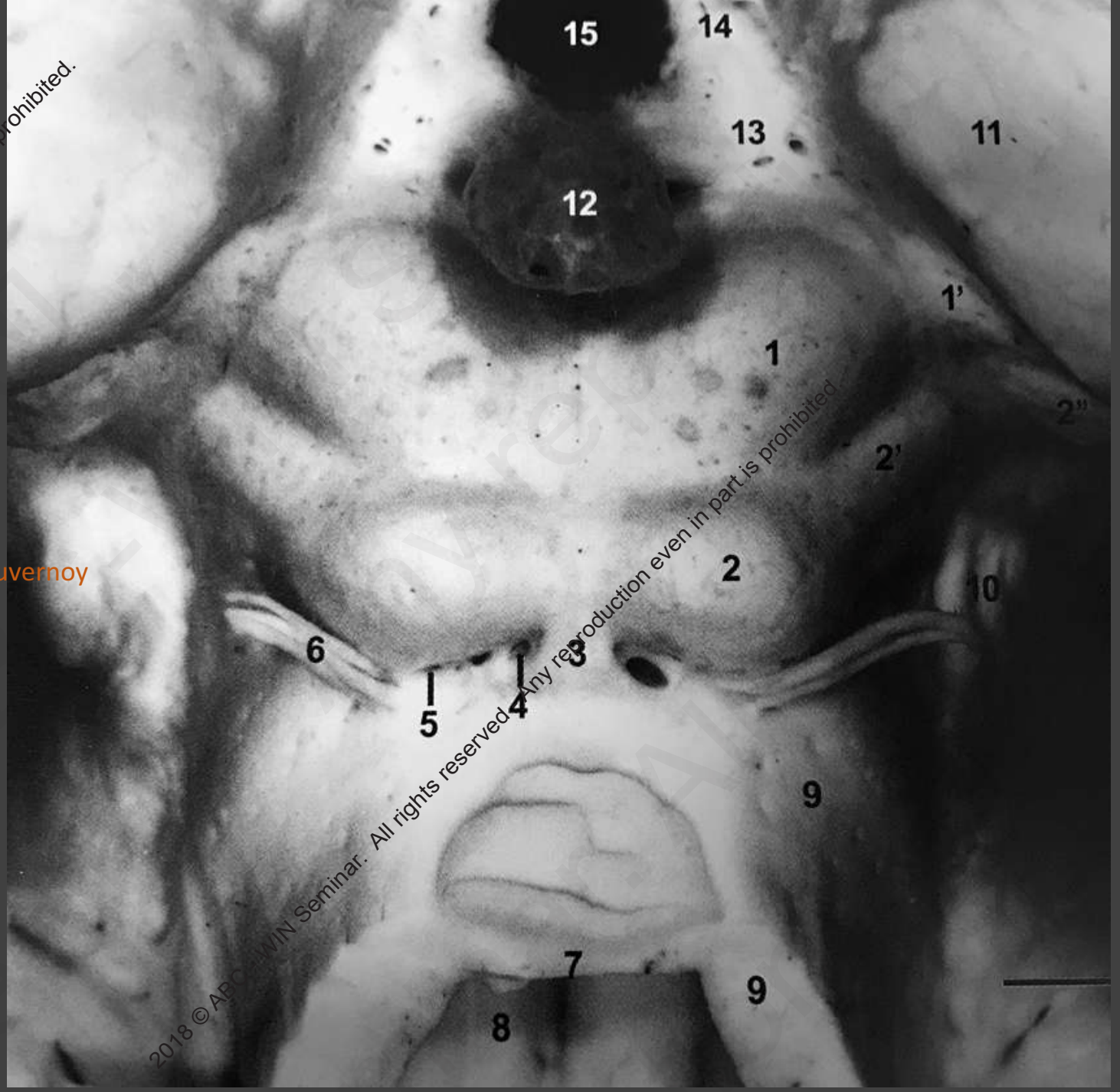
FIGURE 14-13 The Diencephalon and Brain Stem. **(a)** Lateral view, as seen from the left side. **(b)** Posterior view.





Naidich & Duvernoy





Caudal part (inferior colliculi) is simple in structure and functionally part of the auditory system

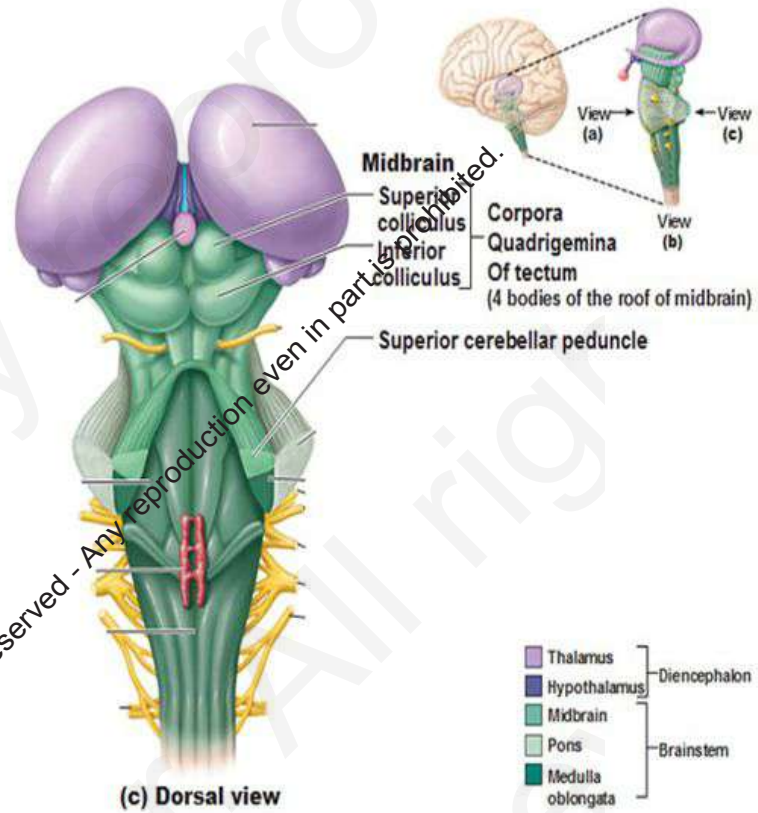
Cranial part (superior colliculi) is more complex in architecture and are an integral part of the visual system and are a synaptic relay between the optic nerve and the visual occipital cortex

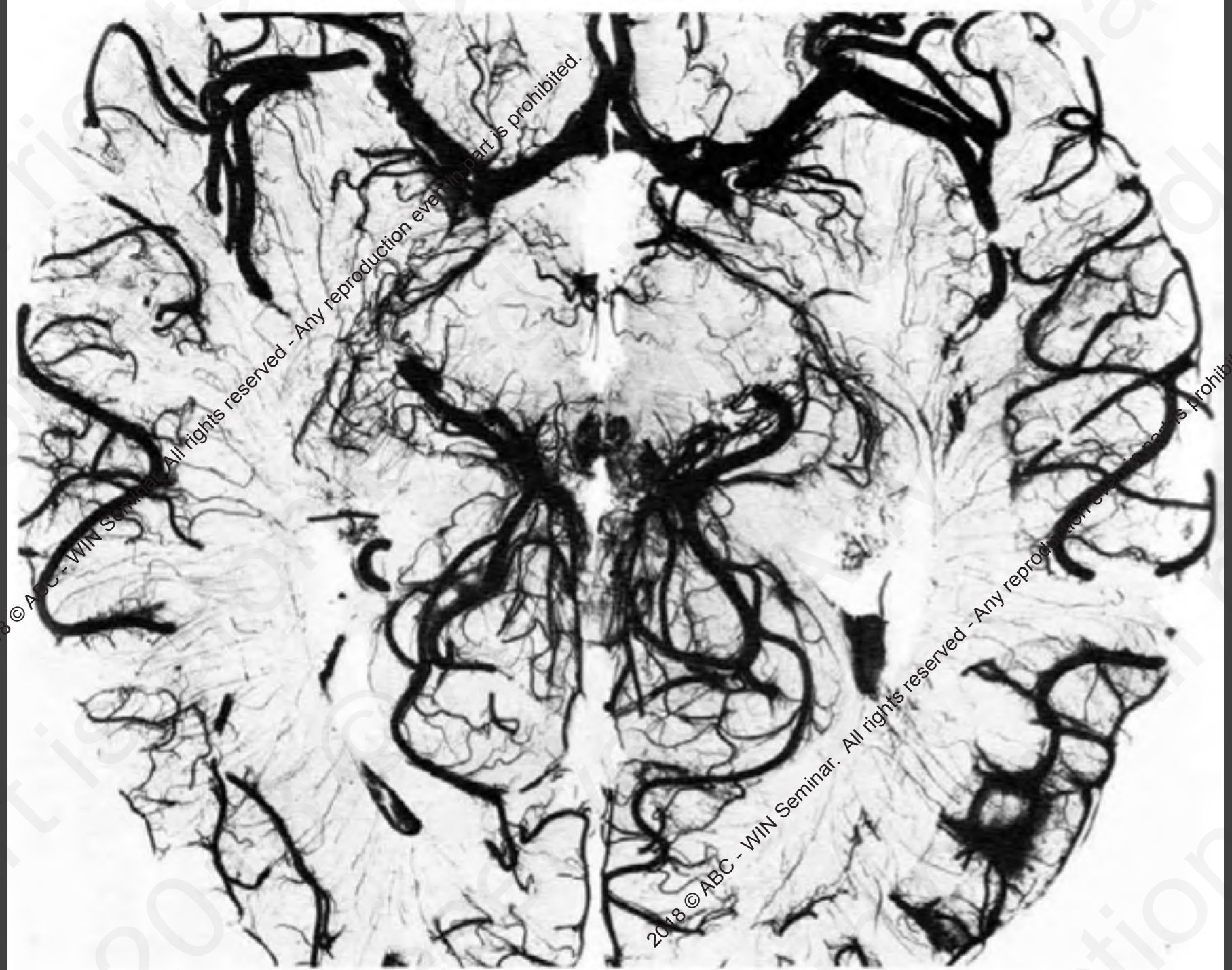
Connexions between superior and inferior colliculi help coordinate visual and auditory reflexes

Brain Anatomy – Midbrain

Includes:

- **Corpora Quadrigemina (tectal plate)**
  - **Superior Colliculus:** Visual reflex center (*turns eyes and head in response to visual stimulus*)
  - **Inferior Colliculus:** Auditory reflex center (*turns eyes and head in the direction of a sound*)
- **Cerebral Peduncles**





Salamon 1970

Collicular artery originates from P1

Turns around the pontomesencephalic sulcus -> gives off branches to the crus cerebri

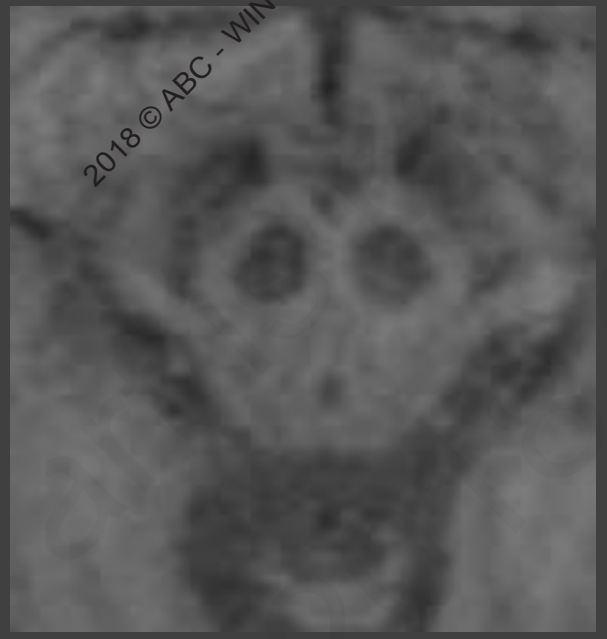
Arrives at tectal plate and divides into a

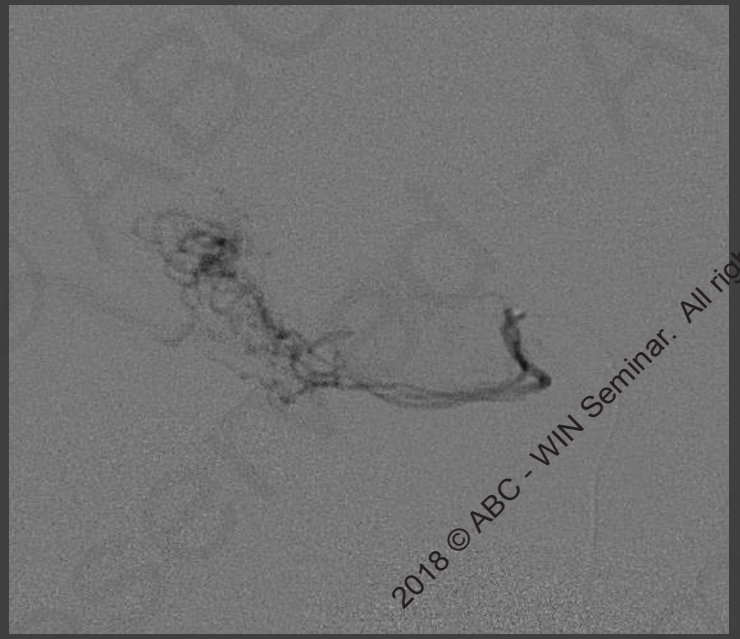
superior branch for the superior colliculus

inferior branch or intercollicular artery for the inferior colliculus and that participates extensively to the tectal network « hiding the subjacent veins » (Duvernoy 1975)

Accessory collicular artery for the lateral part of the superior colliculus

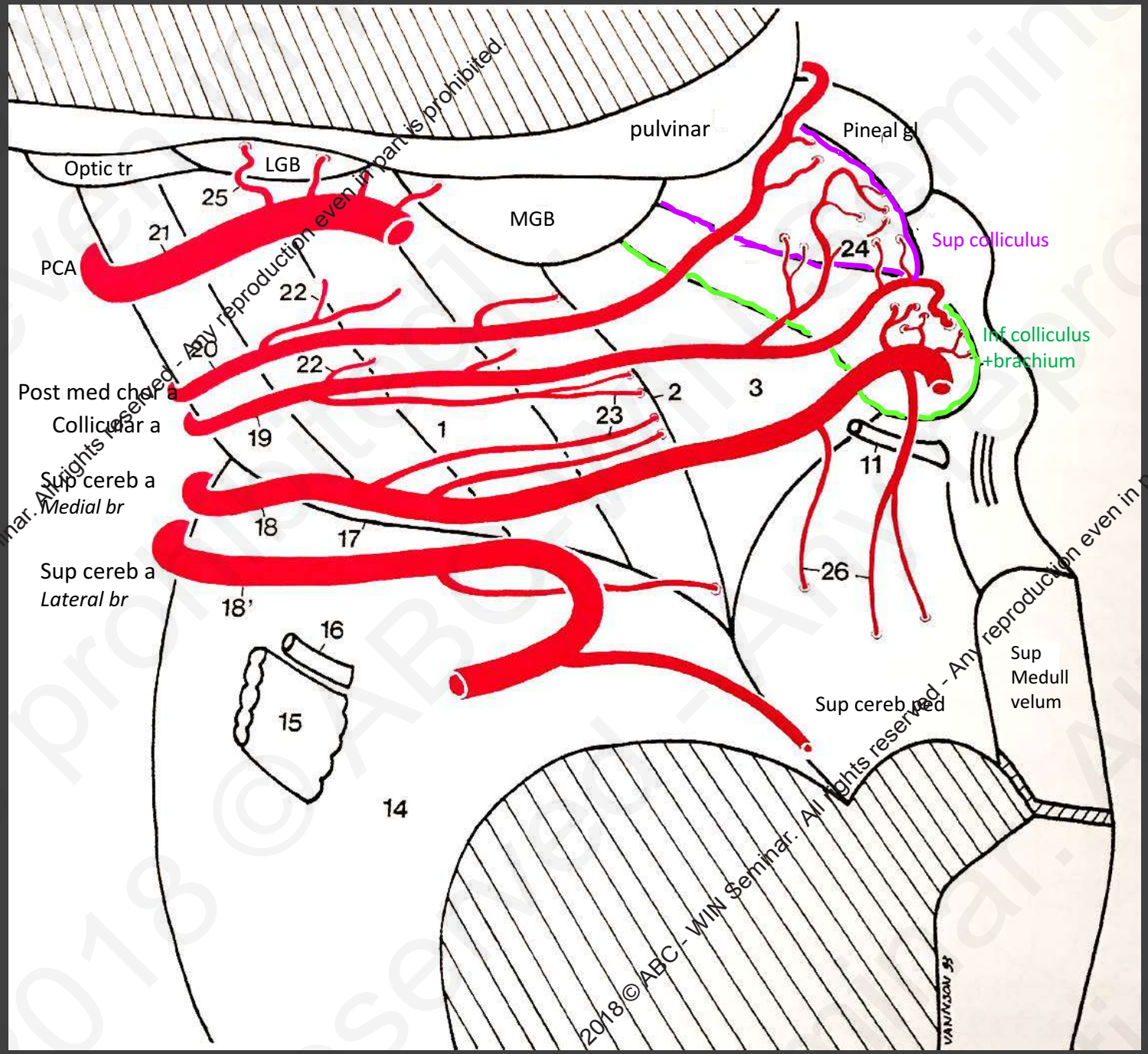
anastomoses with the vessels of the collicular brachium (Pmchor art)





Balance between Pmed Chor a and Collicular a

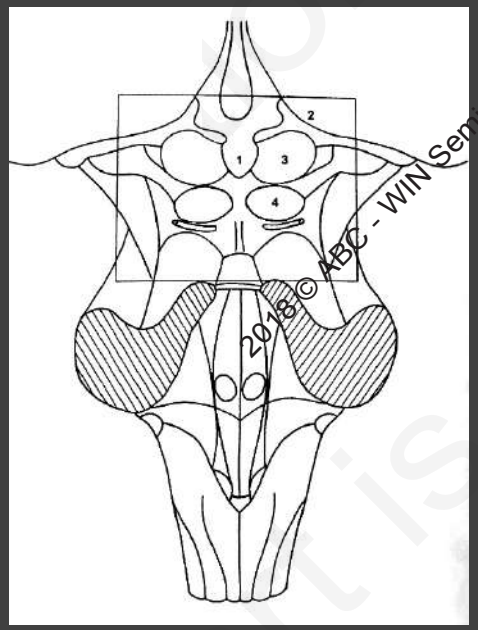
Balance between Collicular a and Sup cereb a



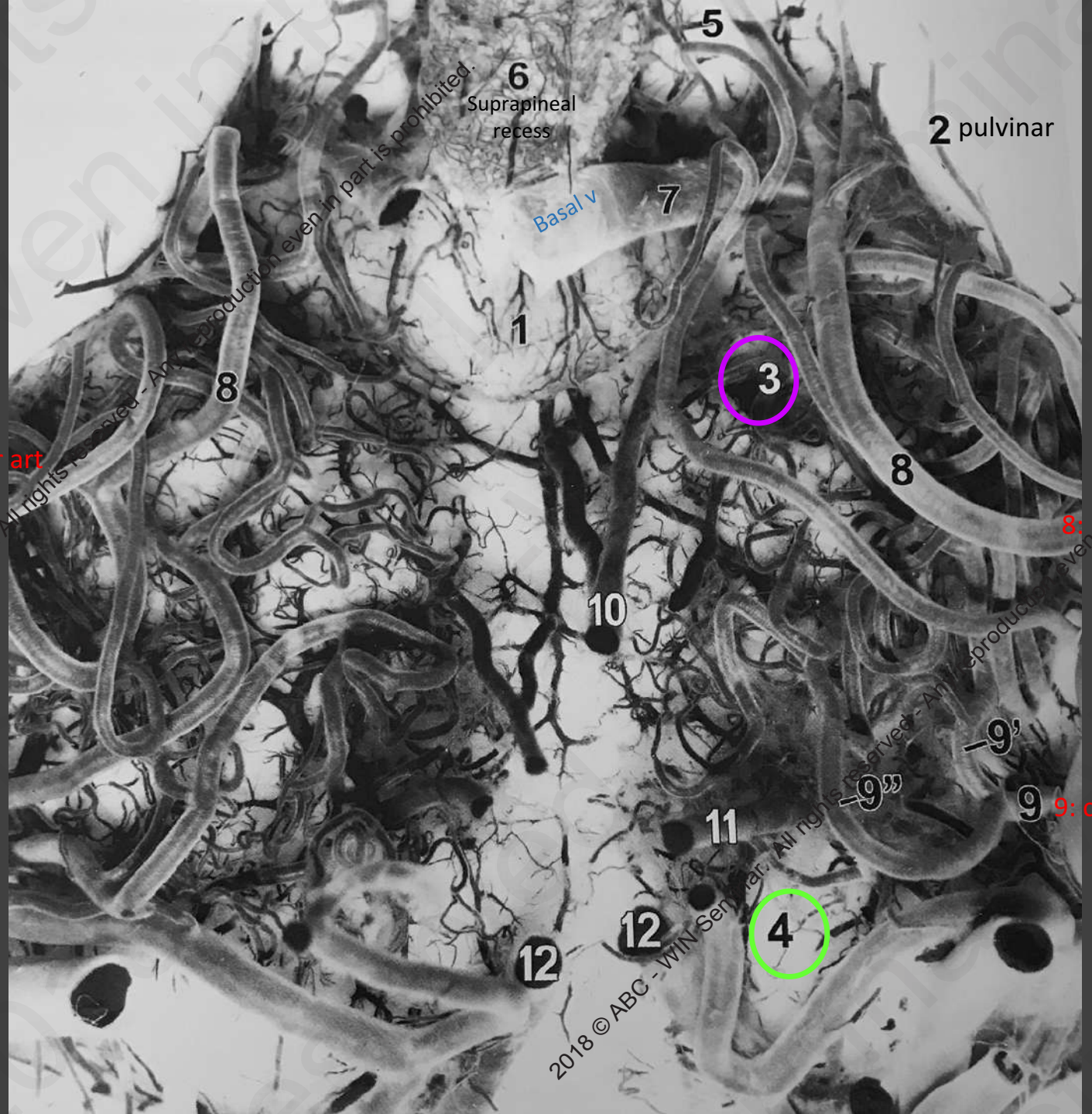
*vascular network of sup colliculus mainly from collicular a
*superior edge of sup colliculus often co-vascularized by Pmed Chor a

Arterial network of inf colliculus mainly from sup Cereb a (+/- from collic a)
*Vascular density at intercollicular sulcus

Mesencephalon: posterior view



Naidich and Duvernoy



1: Pineal gland

3: sup colliculus

8: post med chor art

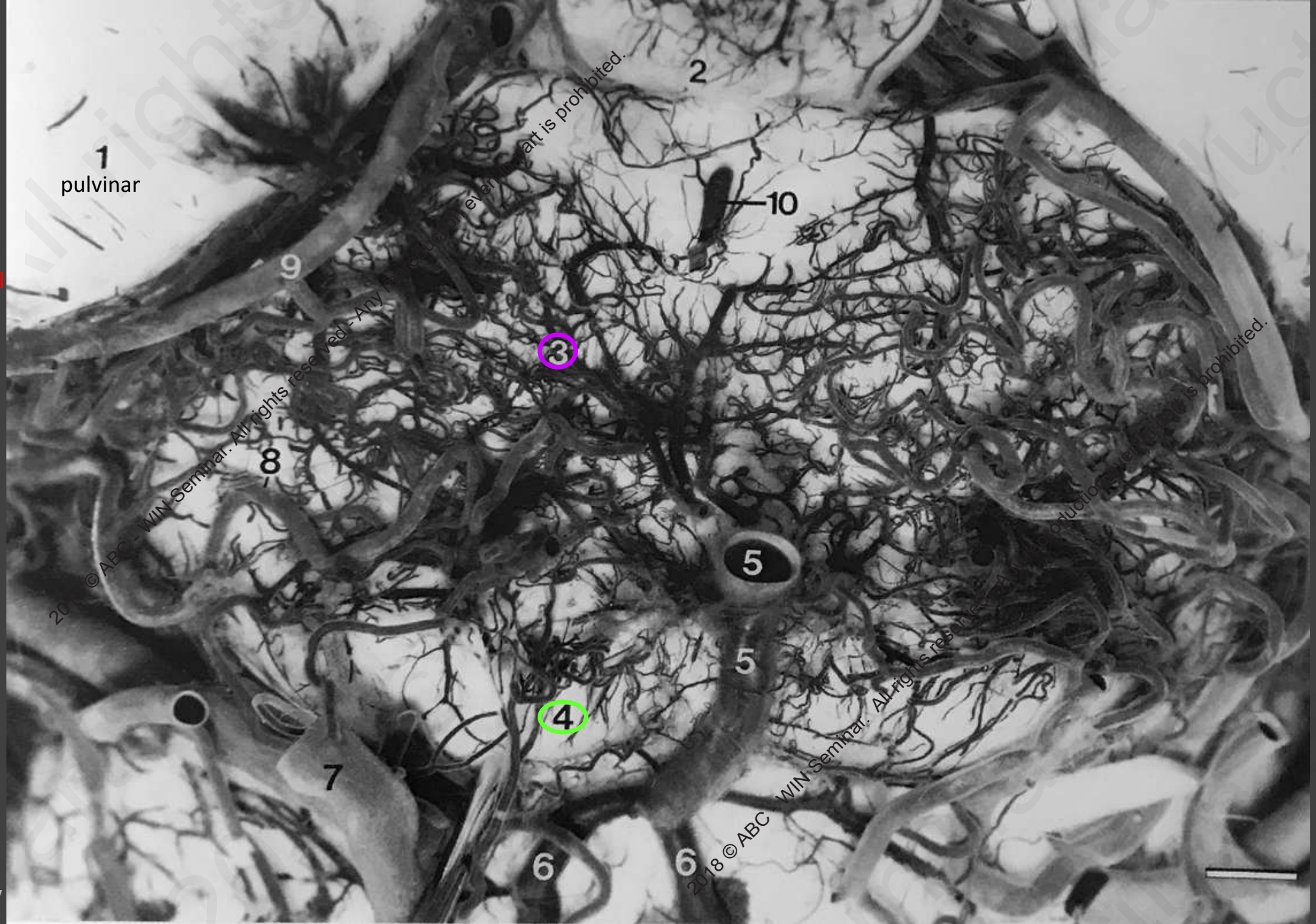
10: medial collic v

9: collicular art

11: Intercollicular v

4: inf colliculus

Mesencephalon: posterior view



2:pineal gl displaced upwards

10: sup median Collic v

9: post medial chor art

3: sup colliculus

8: Collic art

5: precentral v

4:inf colliculus

7: sup cereb art

Naidich & Duvernoy

6: v of brachium conj

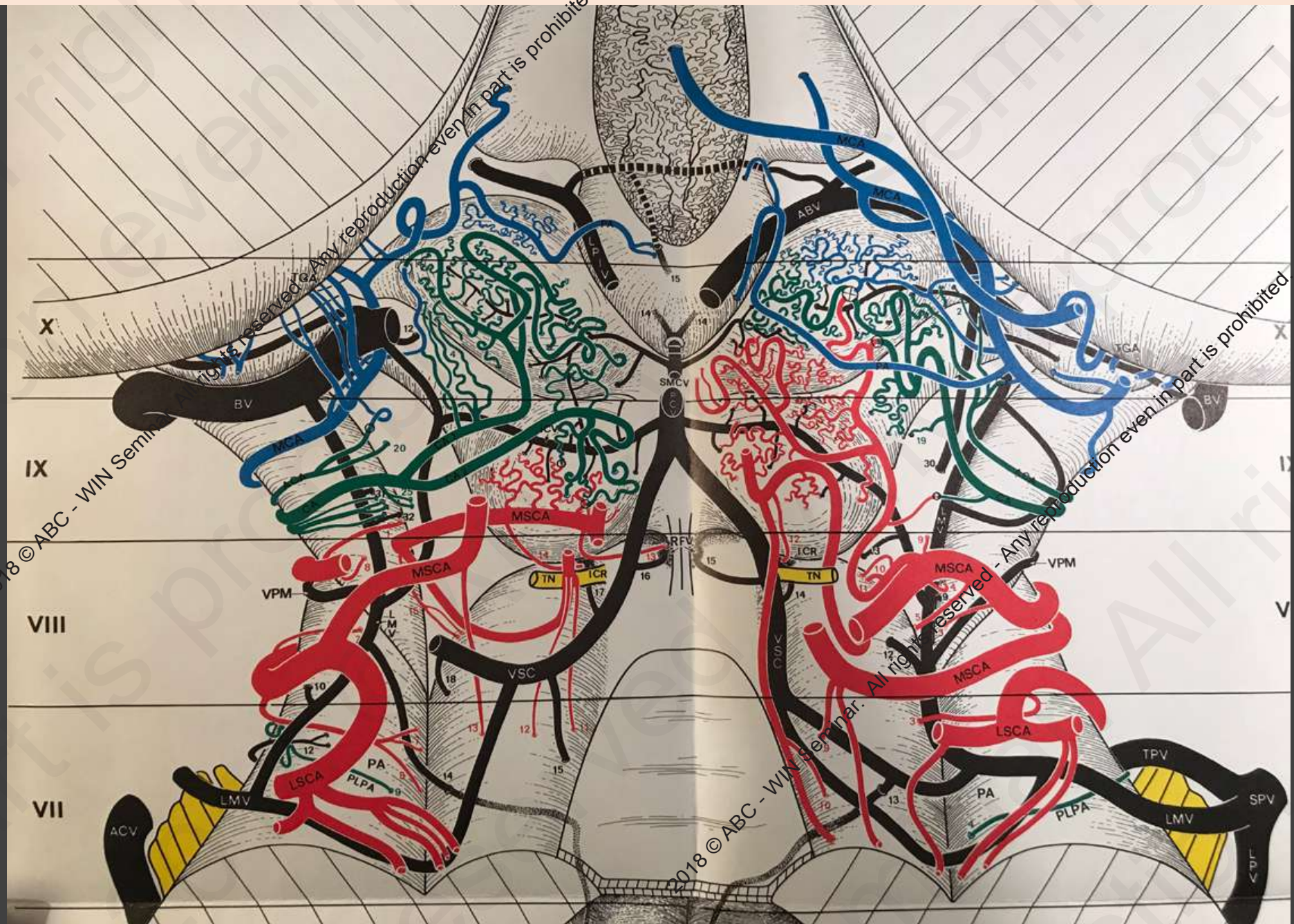
Numerous anastomoses on each side but few anastomoses between left and right networks
(avascular zone along vertical intercollicular sulcus)

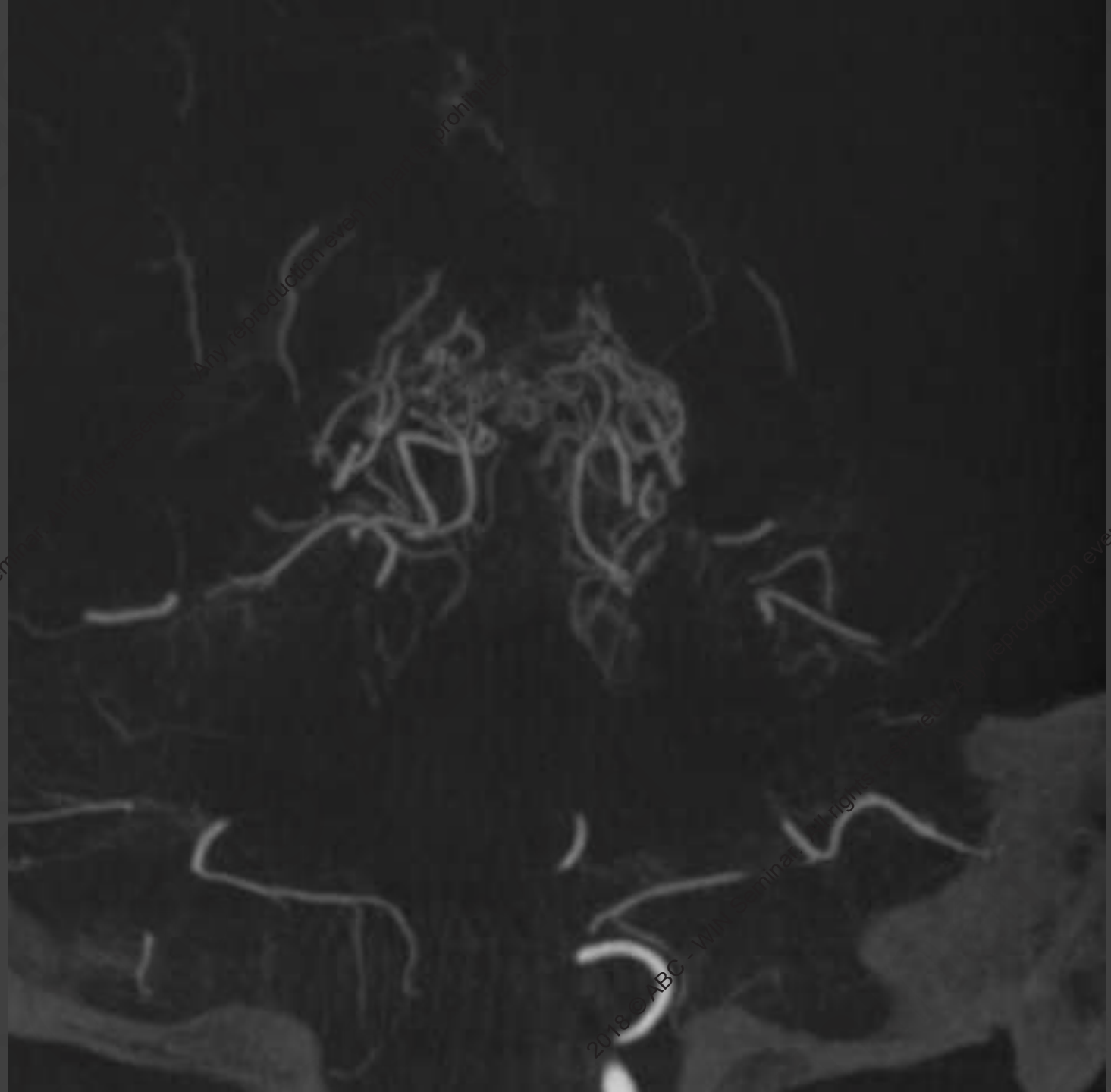
Posteromedial Choroidal a

Collicular art

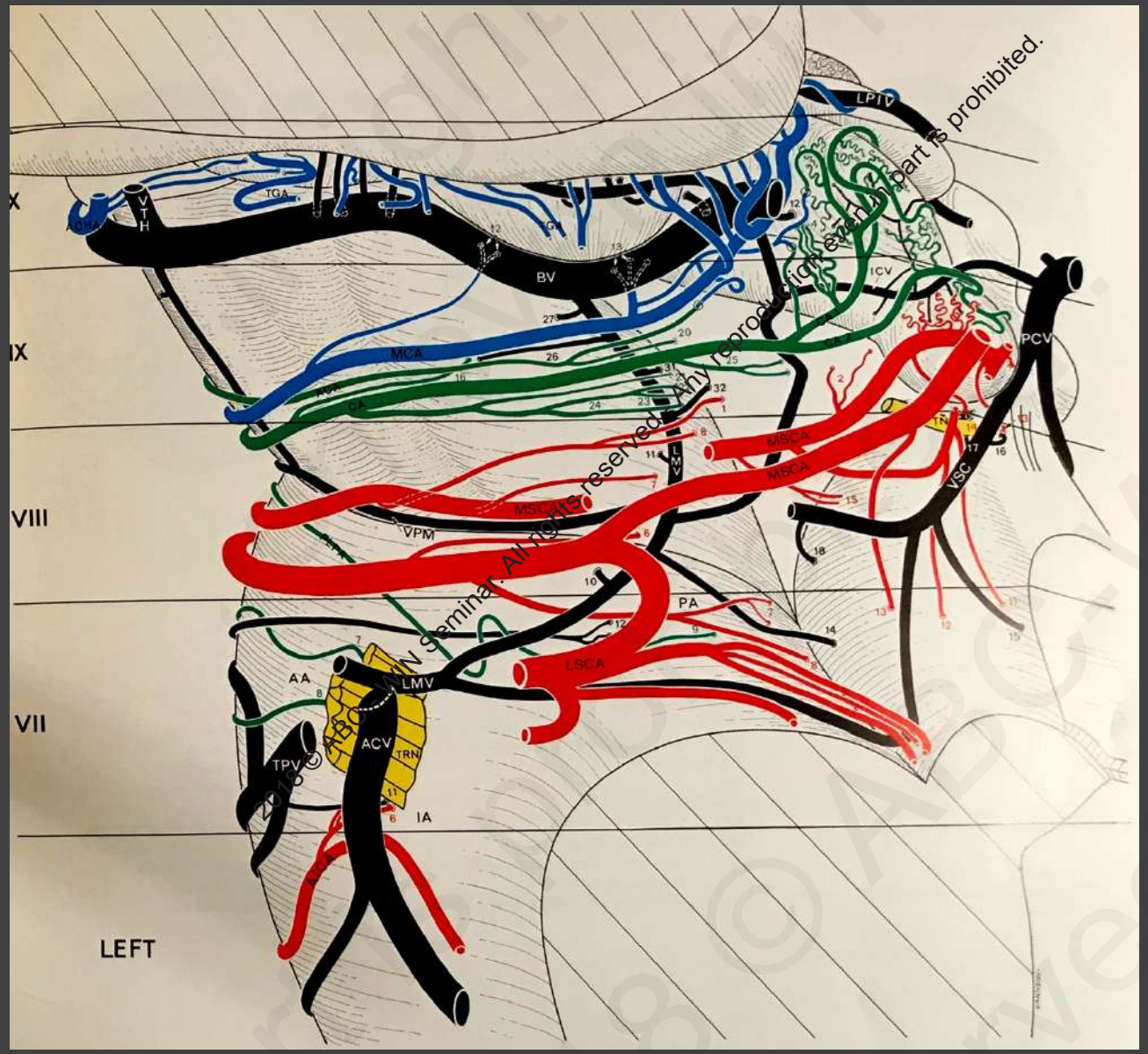
Sup cerebellar a

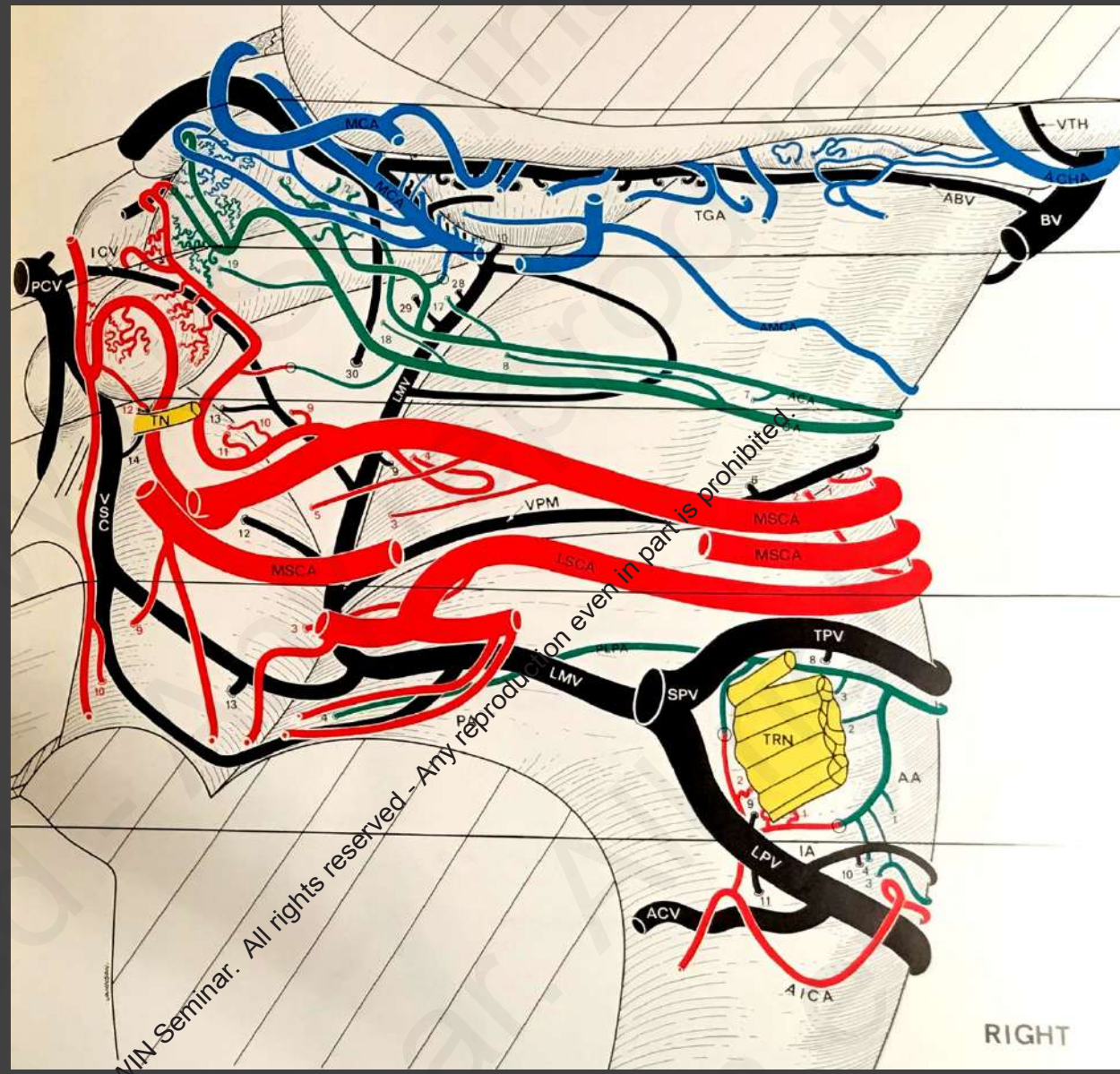
Duvernoy





Courtesy S. Bracard



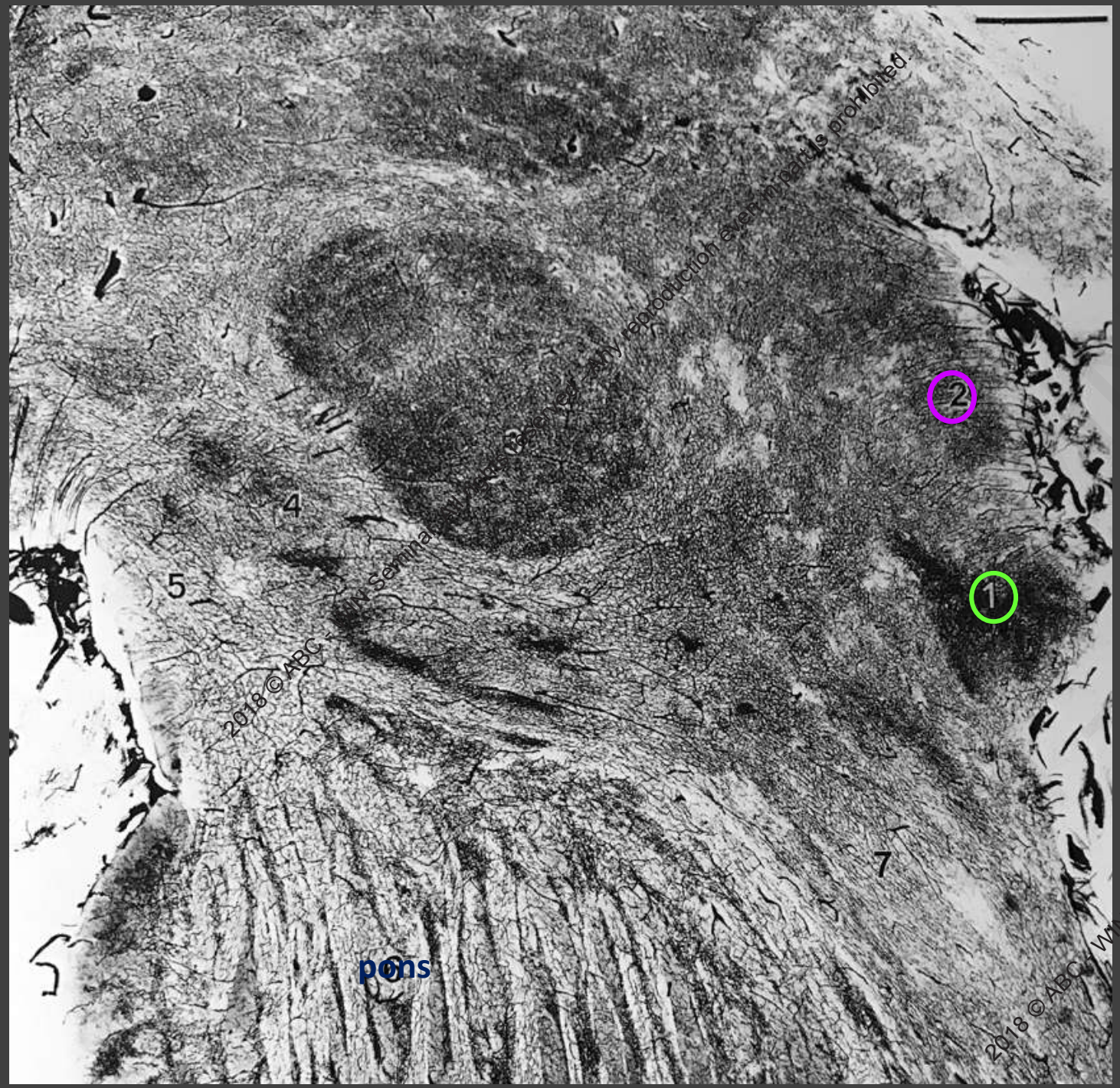


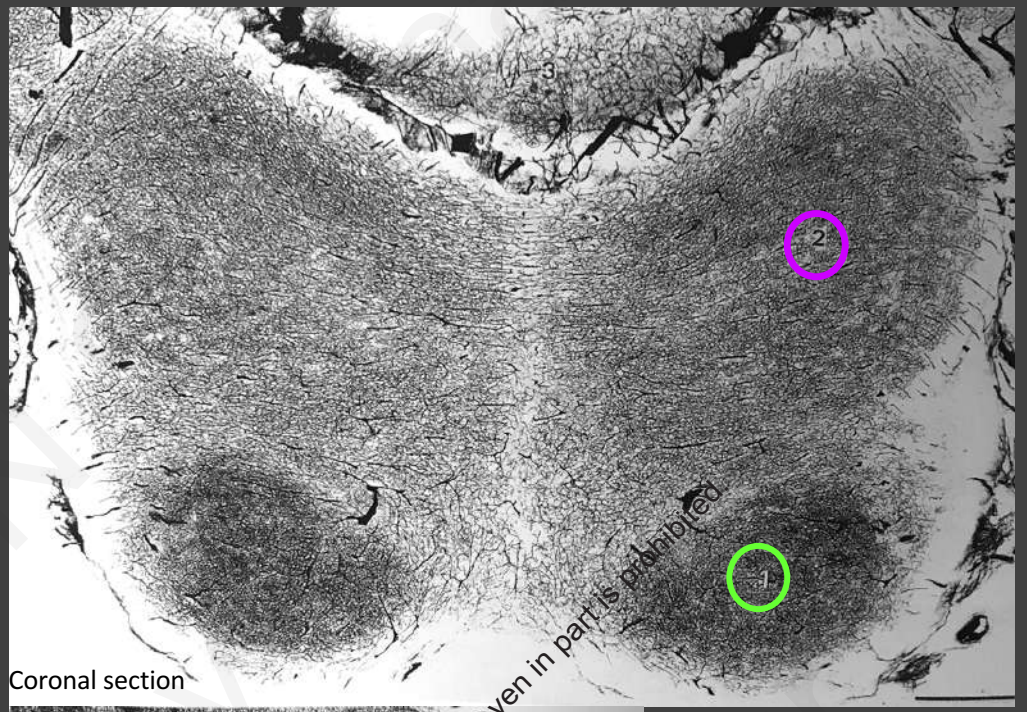
Summary and variations

Green: collicular arteries

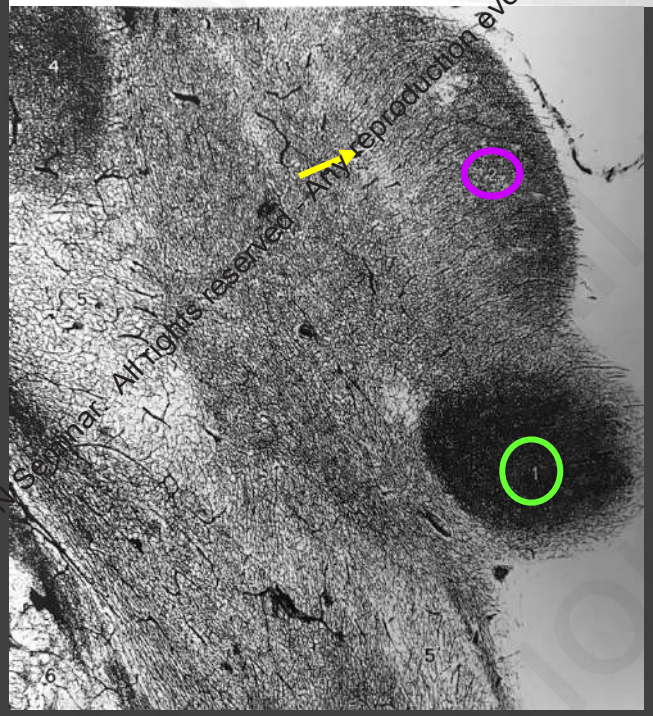
red: medial superior cerebellar arteries

blue posteromedial choroidal arteries

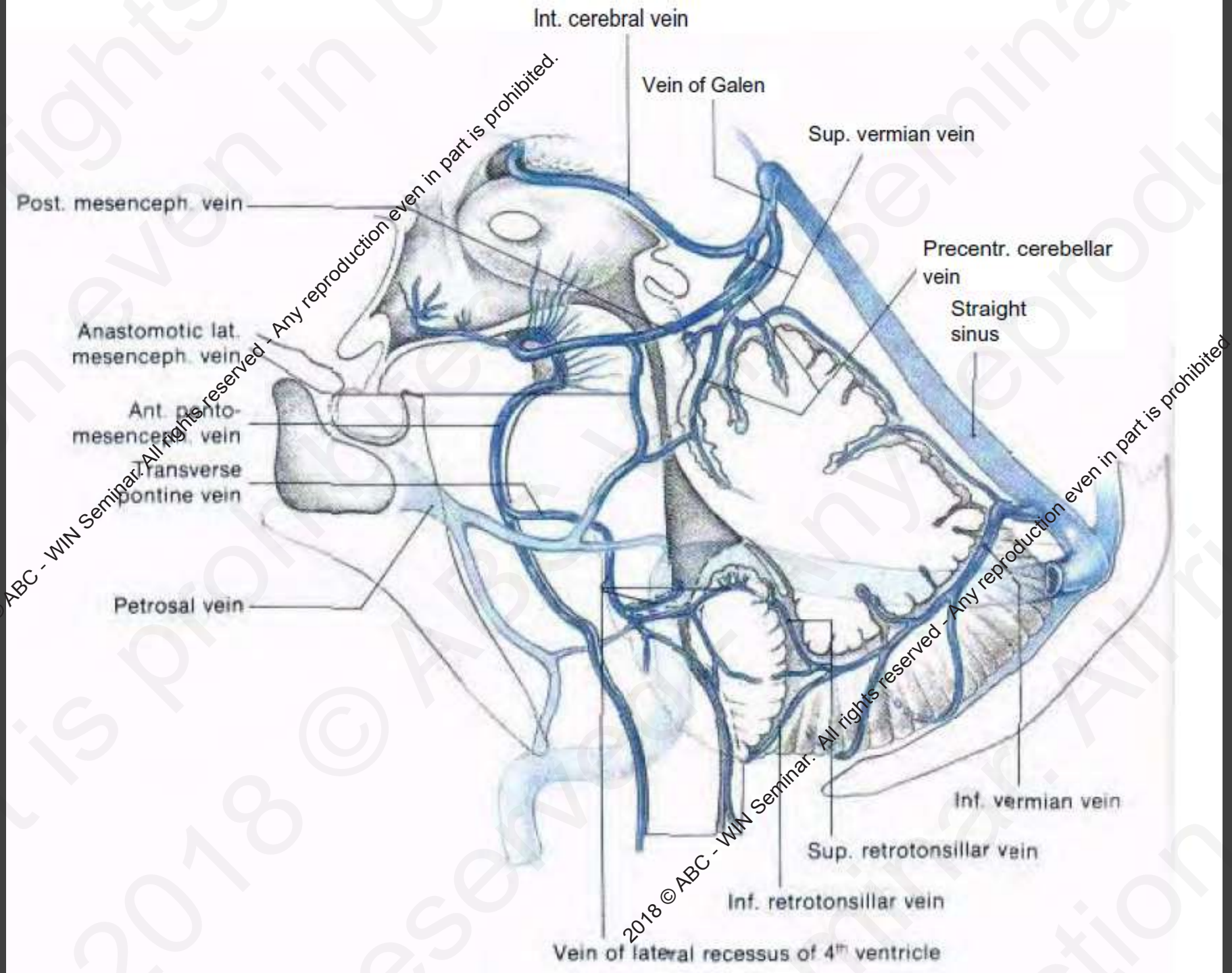




Coronal section



Naidich & Duvernoy



Yasargil

Superficial veins of colliculi:
less numerous than arteries

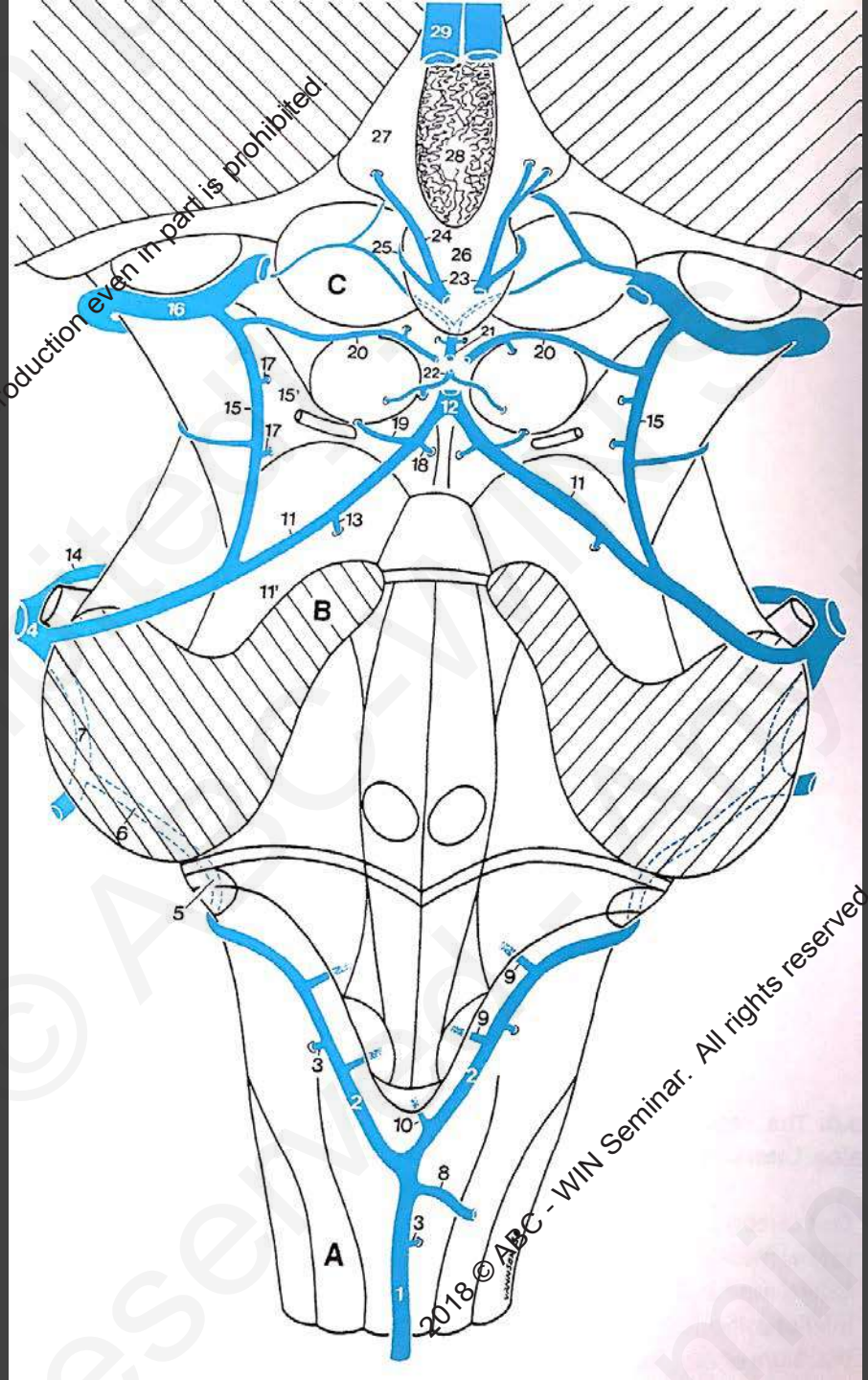
Mainly occur at periphery of colliculi and form
-superior median collicular vein
-inferior medial collicular vein

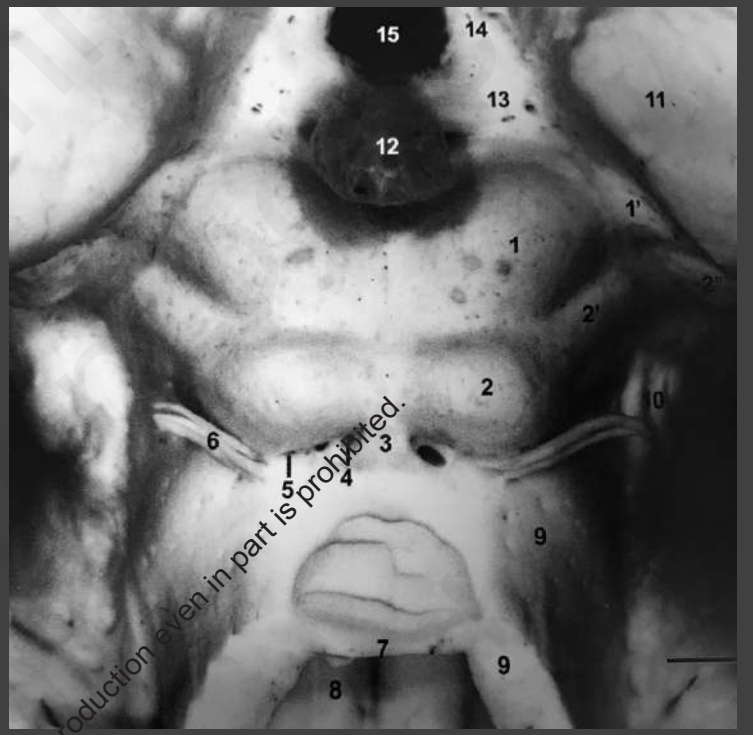
Peripheral collicular veins:
Emerge from the surface of colliculi

Central collicular veins:
Emerge near the midline

Principal lateral veins and the central collicular veins drain

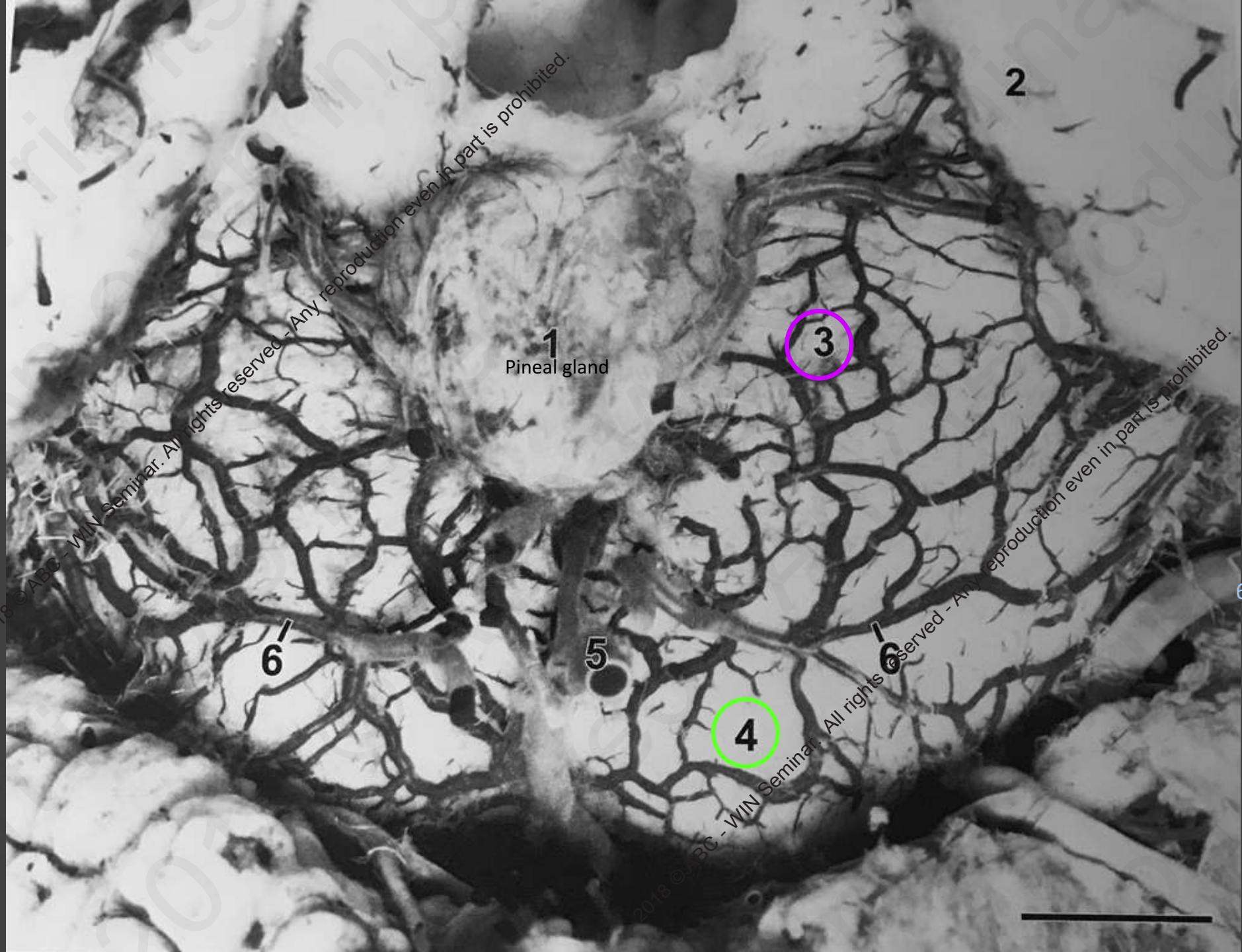
-part of red nucleus
-almost all trochlear and oculomotor nuclei





Naidich & Duvernoy

Colliculi
Venous network



3: sup colliculus

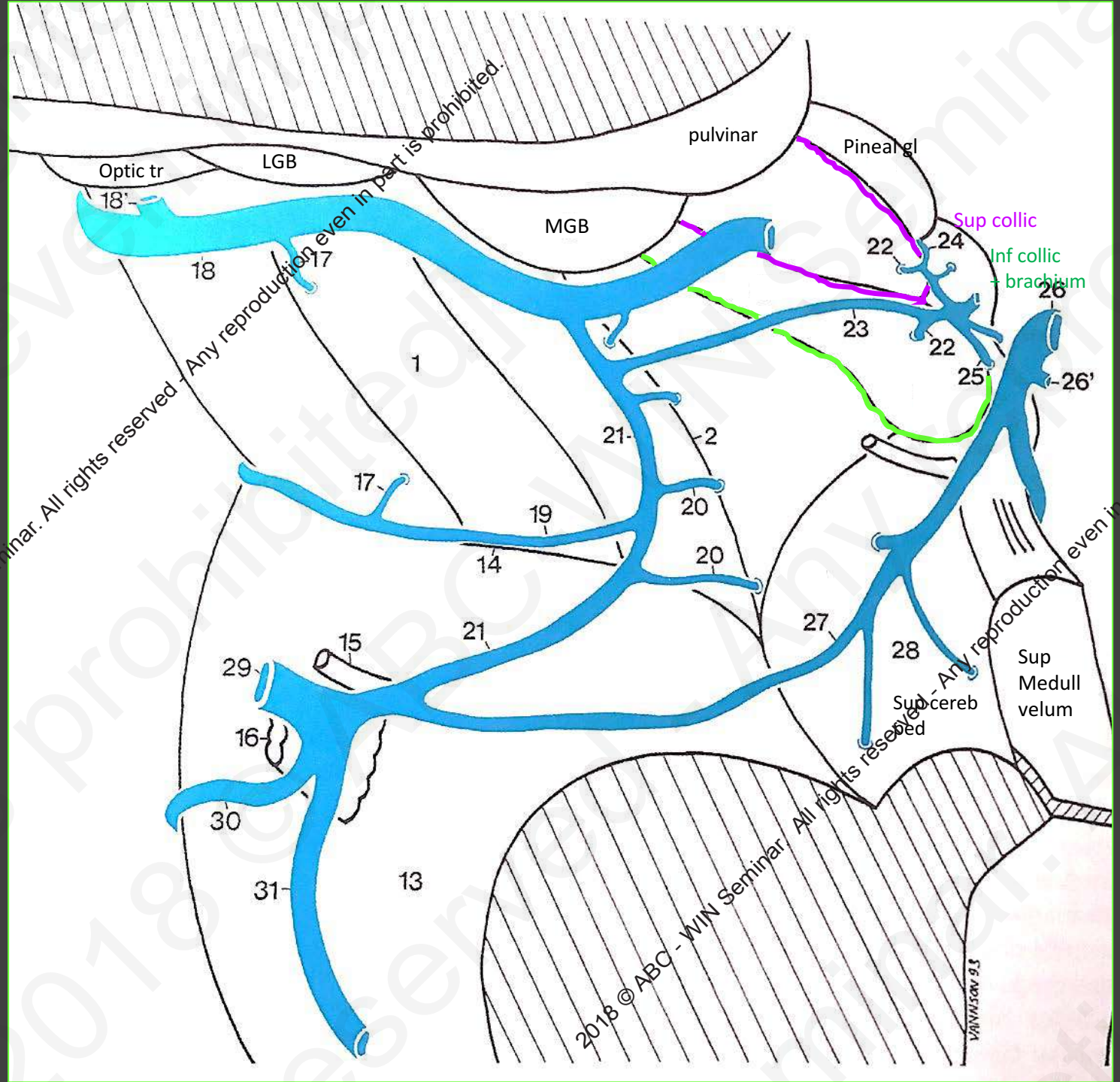
6: intercollicular v

6: intercollicular v

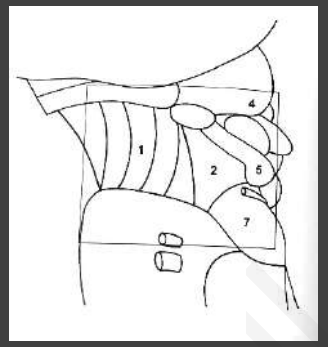
5:Sup med collicular v

4:inf colliculus

Naidich & Duvernoy



Naidich & Duvernoy



15: thalamic br of Post med chor a

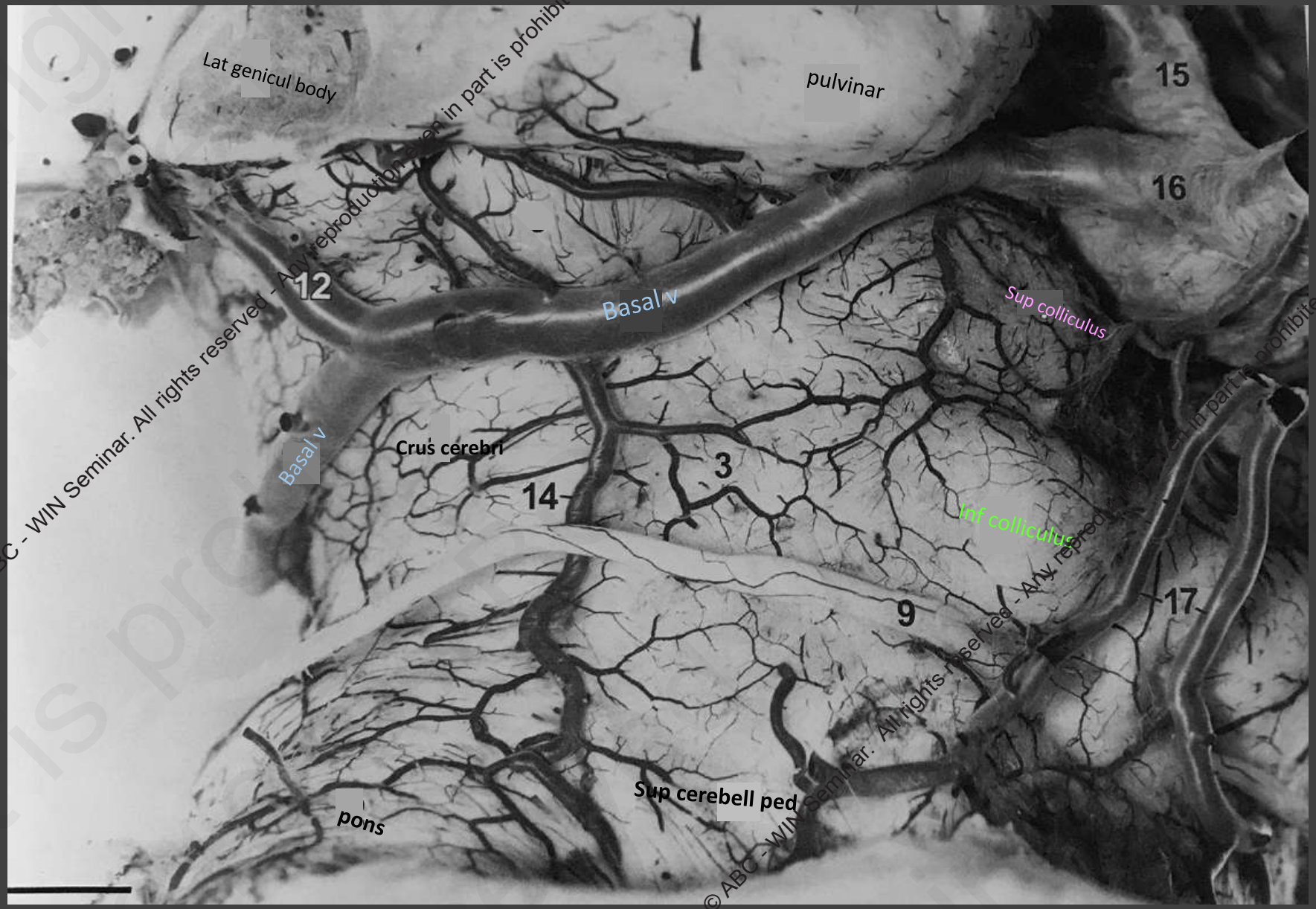
10: post med chor a

11: collicular art

13: latero mesenc v

12: sup cerebell a
' lat br
'' medial br
''' supernumerary br

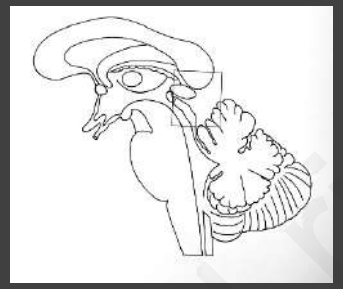
Naidich & Duvernoy

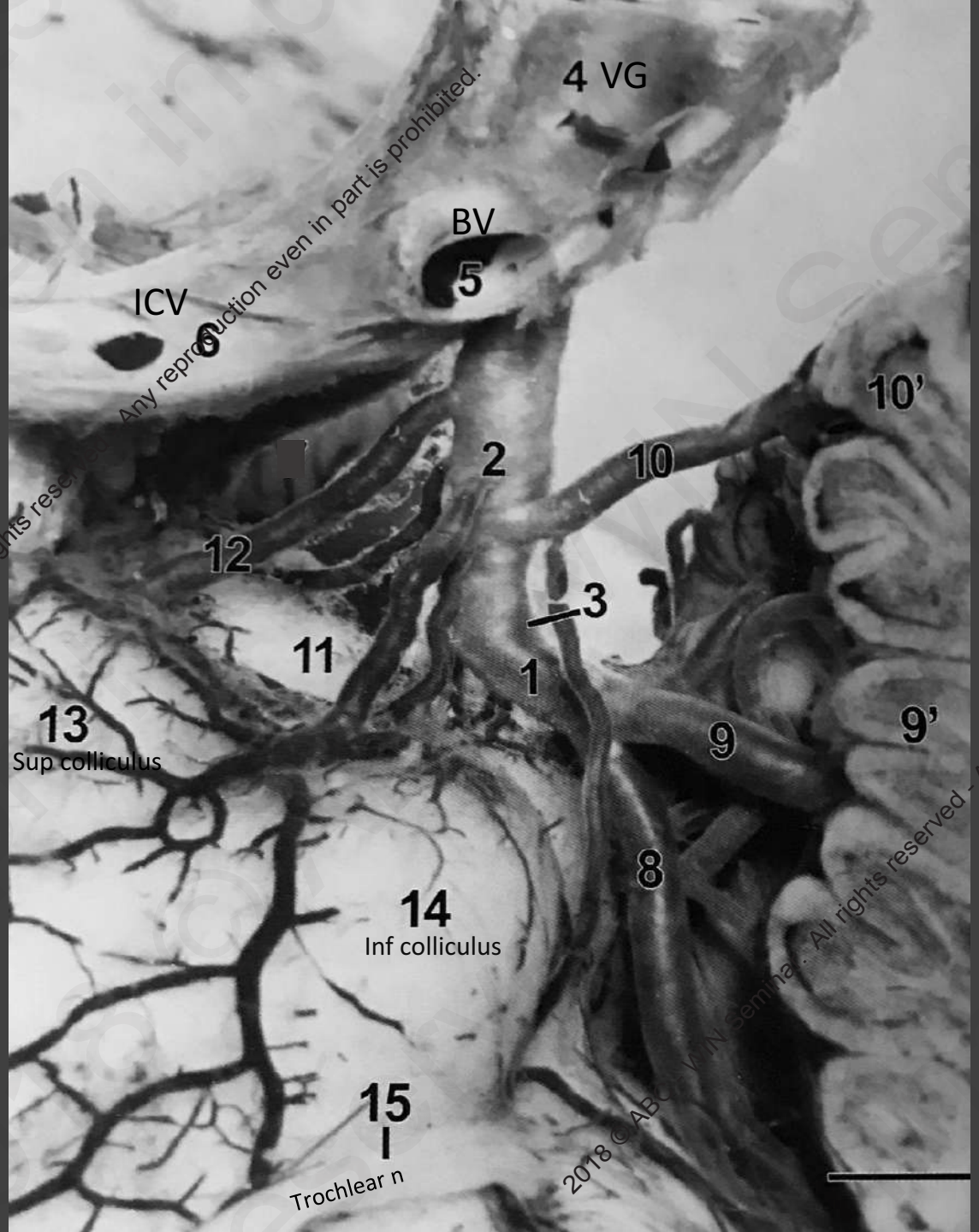


14: latero mesenceph v

17: v of sup cerebell ped

Naidich
& Duvernoy





12:sup medial collicular v

11: intercollic v

2: dorsal segment of precentral cerebell v

10: v of the cerebellar culmen

1: longitudinal segment of precentral cerebell v

9: precentral lobule v

8: superior cerebell peduncular v

Naidich and Duvernoy

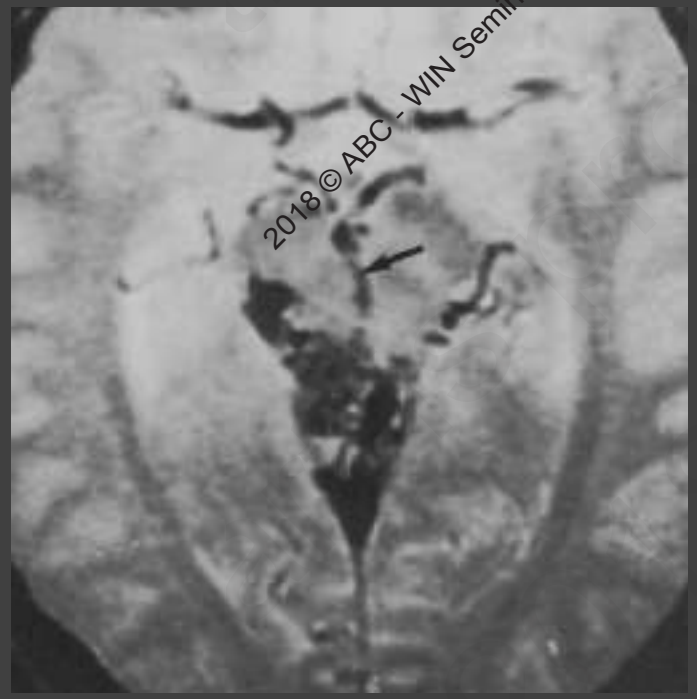
Acta Neurochir (Wien) (1988) 92: 138–143

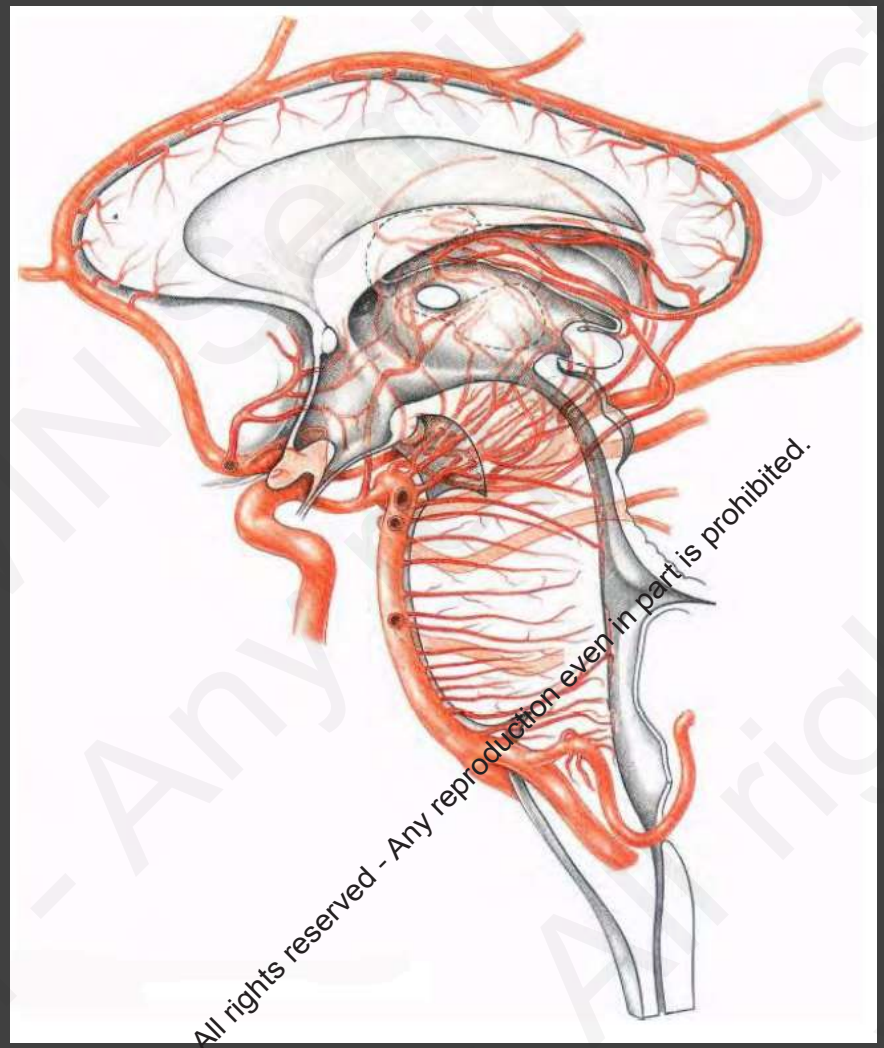
Acta Neurochirurgica

Trans-Mesencephalic Arteries and Veins
Angiographic Aspects in Tectal Vascular Lesions

P. Lasjaunias[1], K. Terbrugge[2], and I. S. Choi[3]

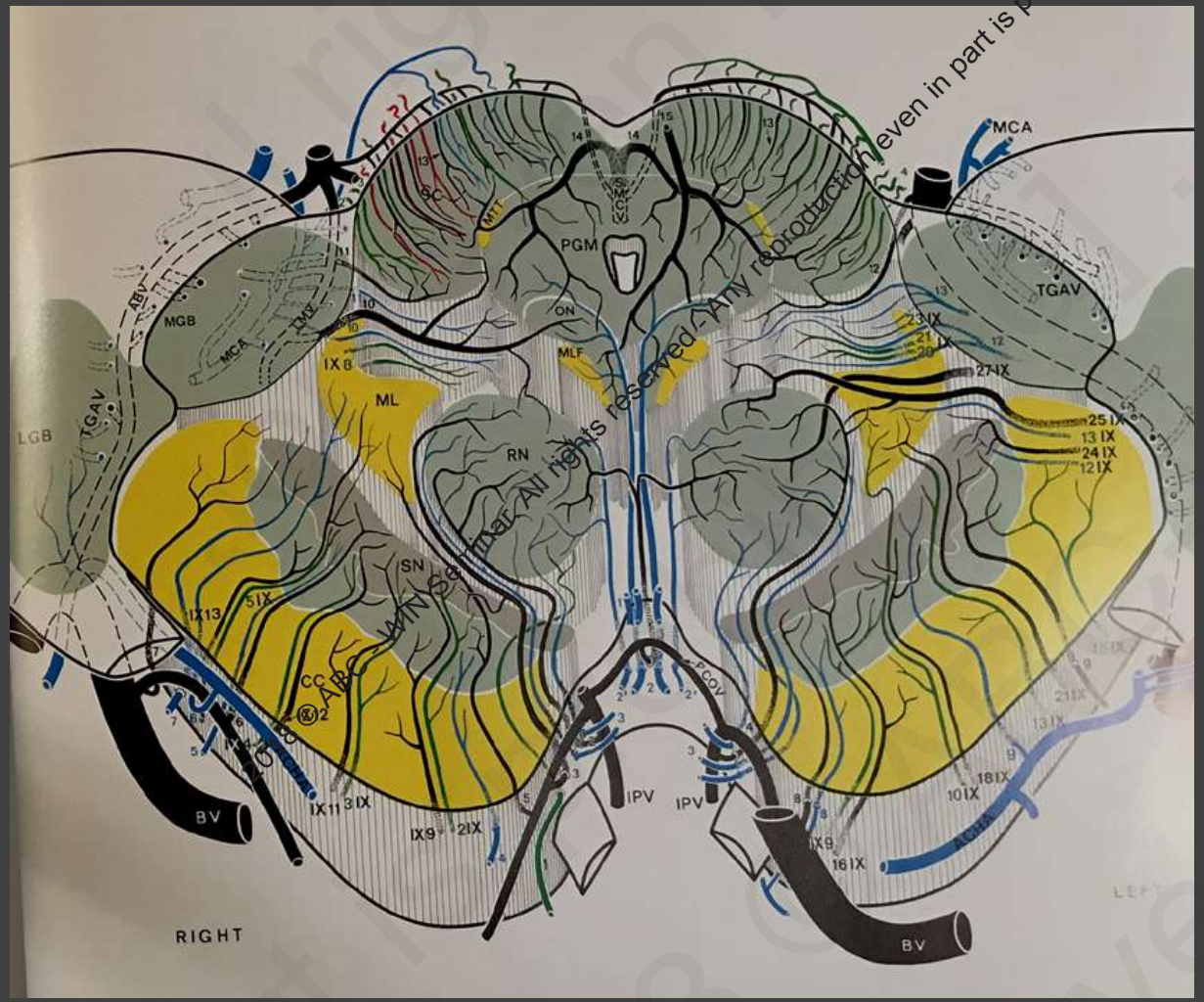
[1] Service de Neuroradiologie Vasculaire, Hôpital de Bicêtre, Kremlin-Bicêtre, France,
[2] Department of Radiology, Toronto Western Hospital, Toronto, Ontario, Canada,
[3] Department of Neuroradiology, Bellevue Hospital, New York City, N.Y., U.S.A.



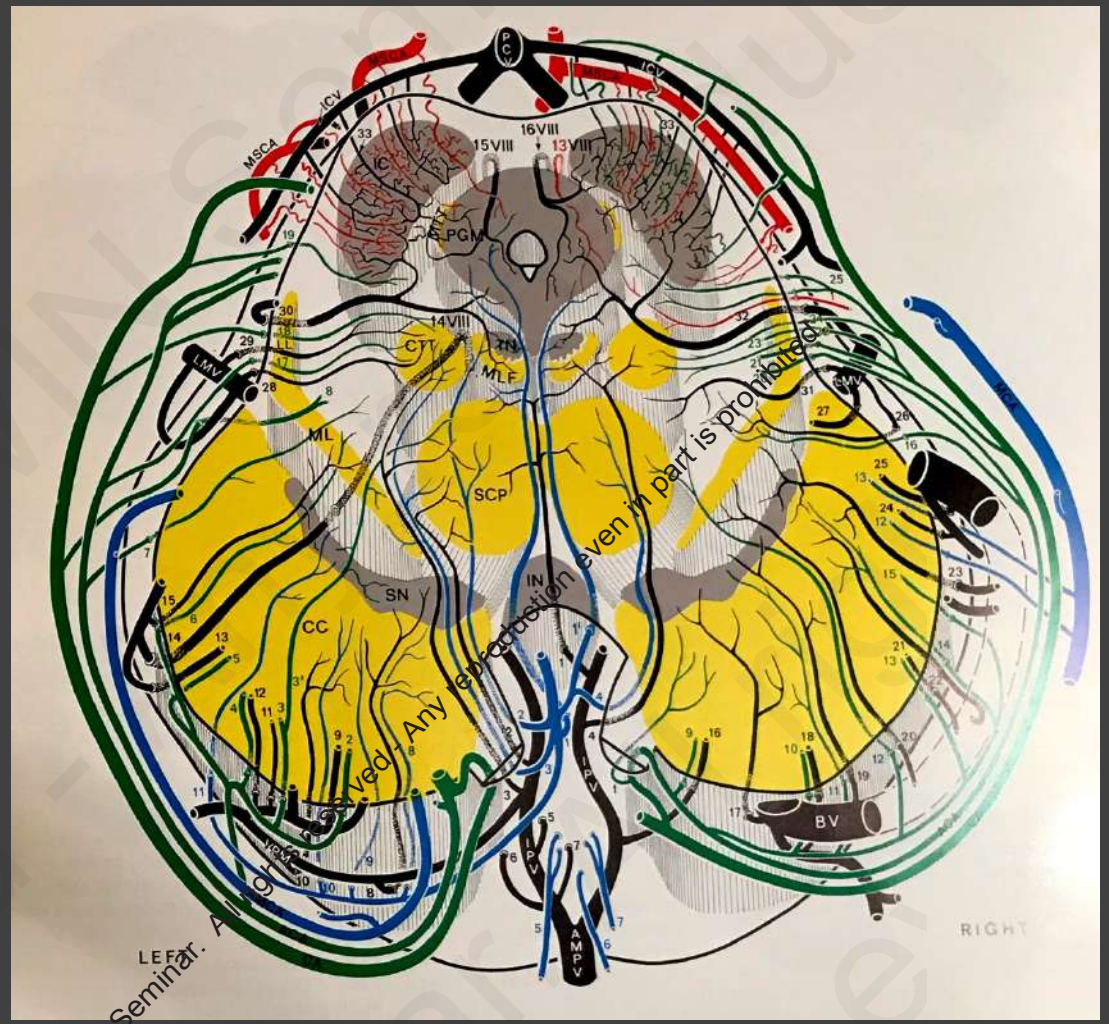


Yasargil

Transmesencephalic supply seen in 21% of mesencephalic AVMs *Lasjaunias 1994*



Axial: Superior colliculus



Axial: Inferior Colliculus

Duvernoy

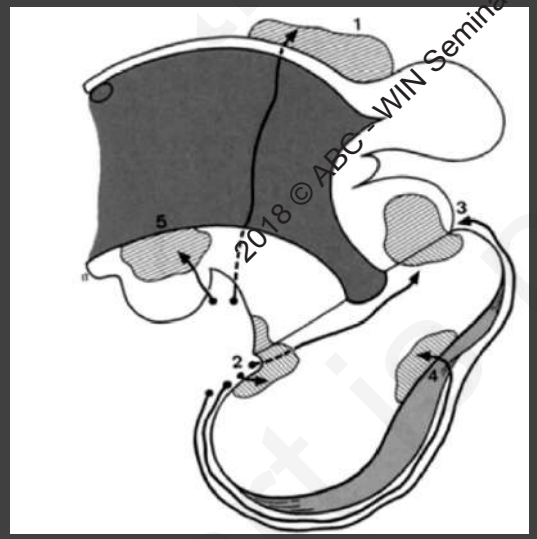
Surg Radiol Anat (1994) 16 : 311-317

Surgical and Radiologic Anatomy
Journal of Clinical Anatomy

Mesencephalo-diencephalic angioanatomy in arteriovenous malformations. Endovascular management of transmesencephalic vs subependymal supply in 954 cases between 1982 and 1994

J Xavier, S Suthipongchai, J Al-Watban, H Alvarez, G Rodeschini and P Lasjaunias

Service de Neuroradiologie Vasculaire Diagnostique et Thérapeutique, Hôpital Bicêtre, 78, rue du Général Leclerc, F-94275 Le Kremlin Bicêtre, France

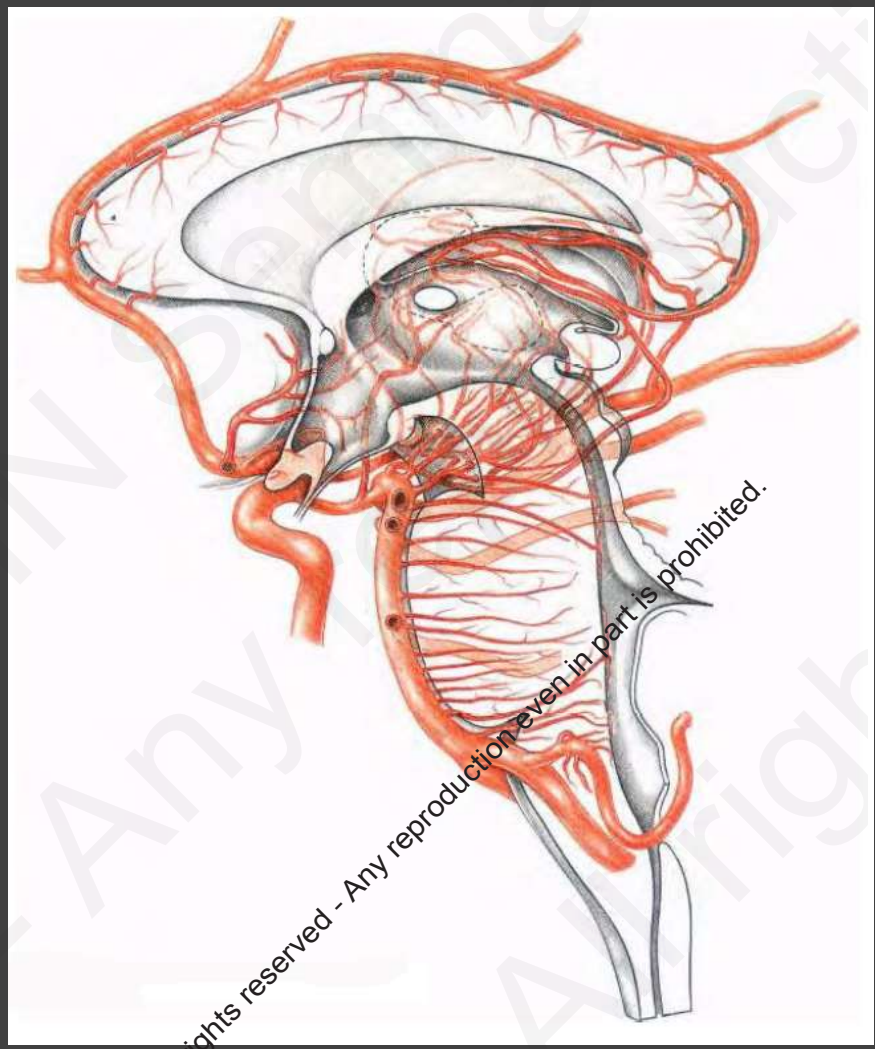


Anterior thalamic perforators arise proximally from the caudal division of ICA and run vertically or slightly horizontally

Posterior thalamo perforators arise from P1 and have a nearly vertical supendymal course parallel to the basilar artery main direction

Lateral A° projection: above P2 towards choroid region

AP A° projection: close to midline between PCAs



Yasargil

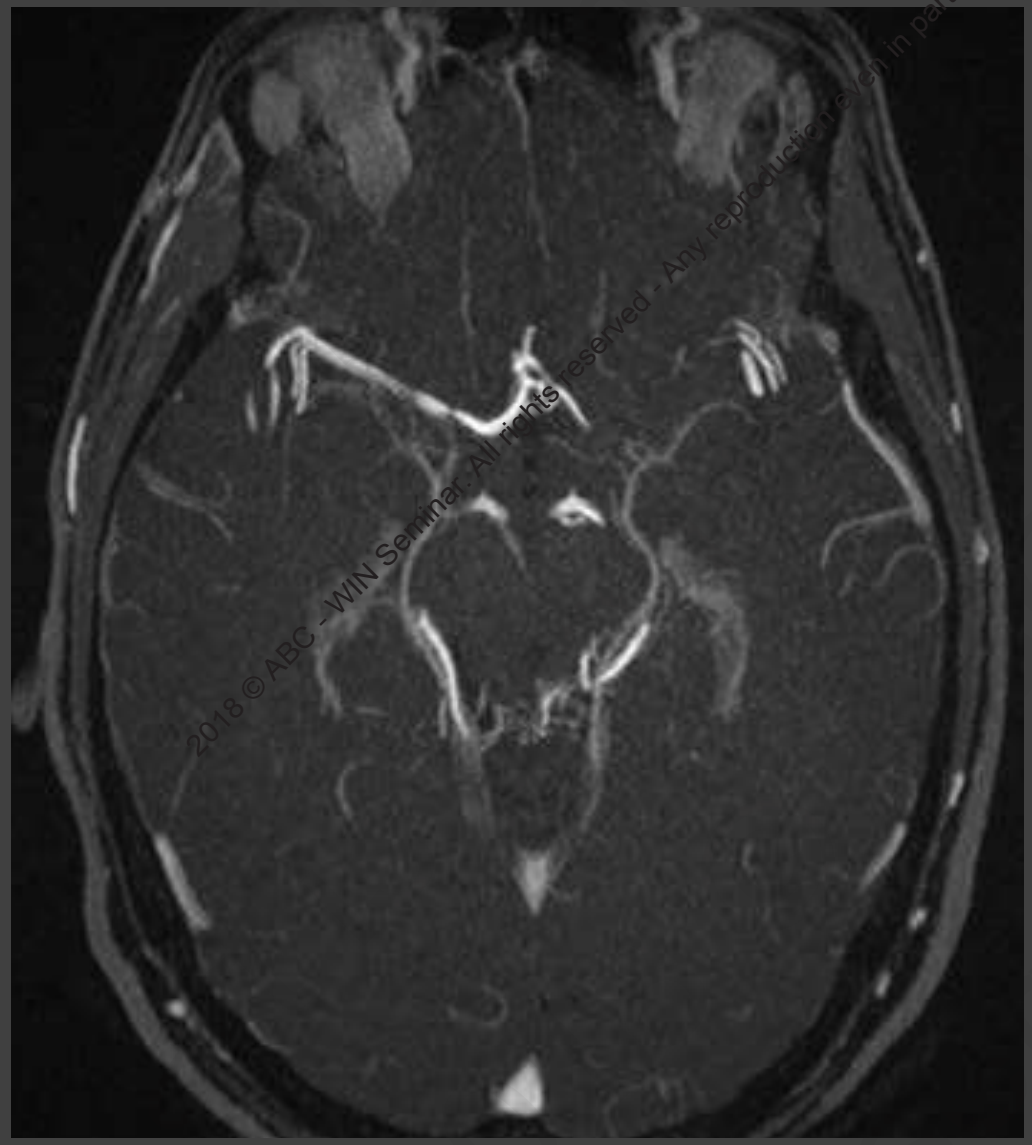
Mesencephalic perforating arteries have an horizontal course, perpendicular to the basilar artery main direction

AP A° projection: close to midline

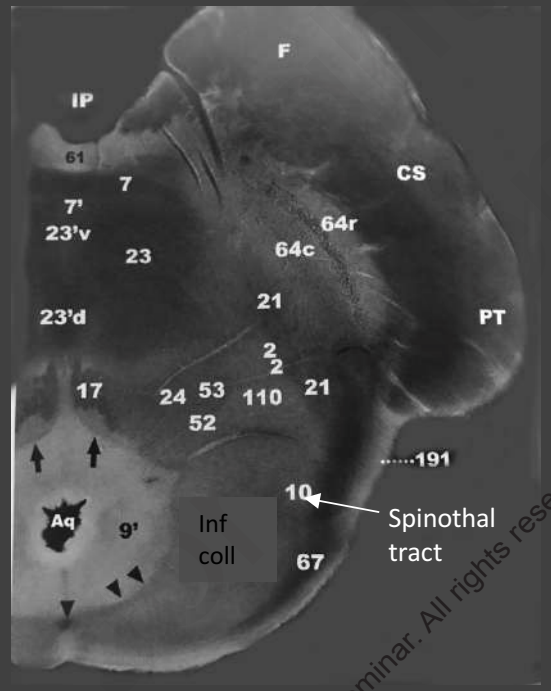
Lateral A° projection: below/ at level of P2

(diff diag with circumflex a that have more post course)

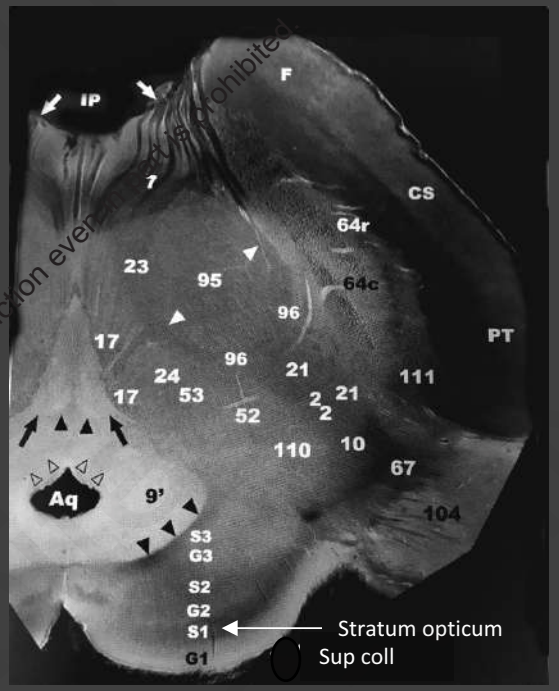
Epipial



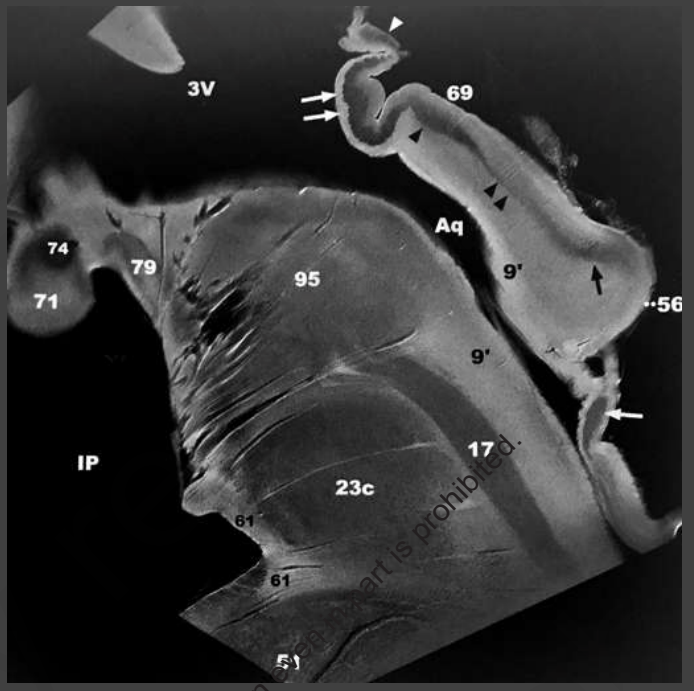
Subpial



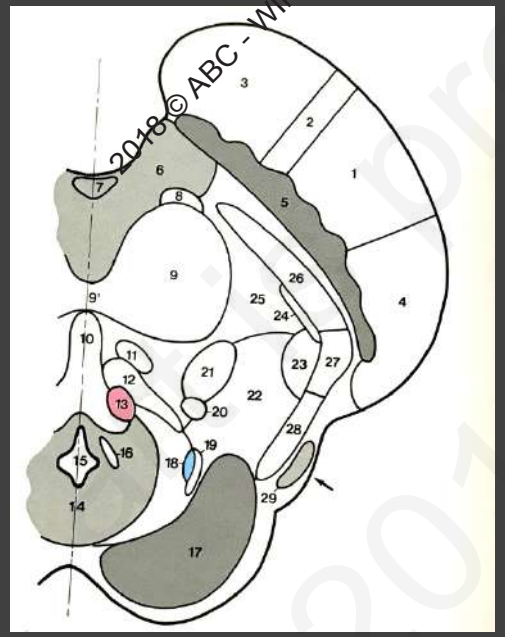
Section through the Inf colliculus

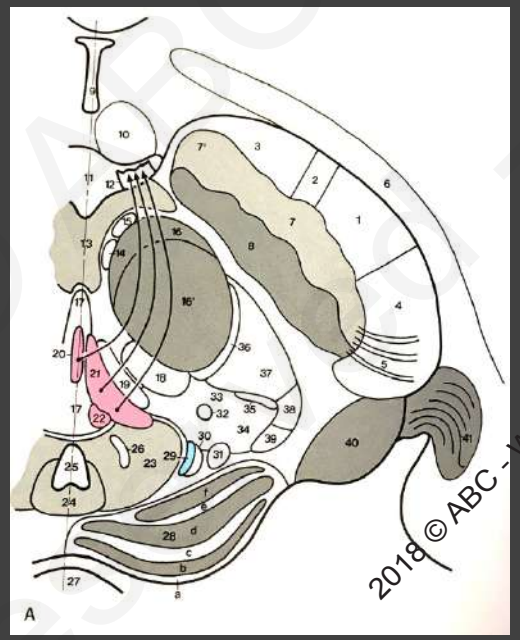


Section through the superior colliculus



Mesencephalon: sagittal section



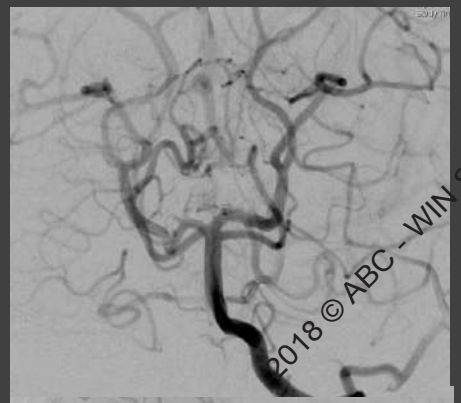


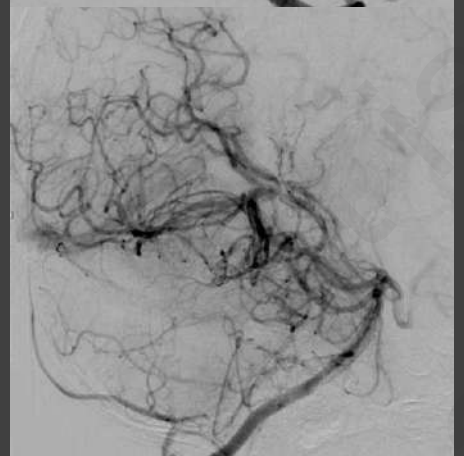
Naidich and Duvernoy

Vascular Anatomy allows recognition and differential diagnosis of different vascular malformations

Tectal AVSs

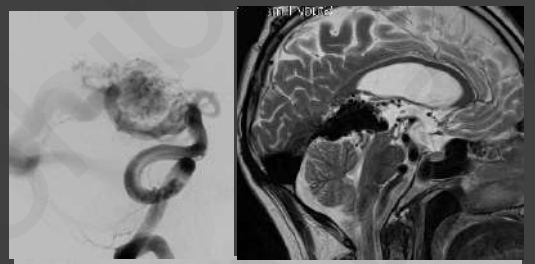
Collicular a
Sup cerebellar a
Transmesencephalic a
Tectal vein
Precentral cerebellar v
VG
Basal v of Rosenthal

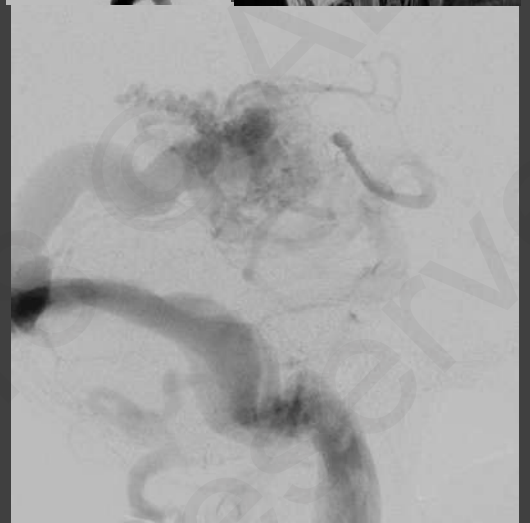




Choroidal AVSs

Anterior choroidal a
Posterior choroidal a
Subependymal a
Choroidal v
VG
Basal v
Reflux into contributors of VGAM



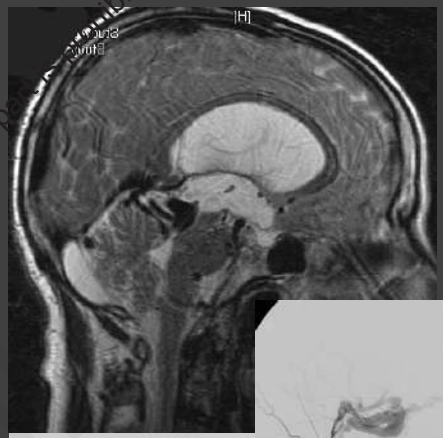


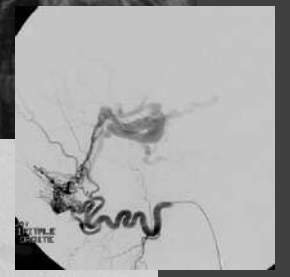
Choroidal VGAMs

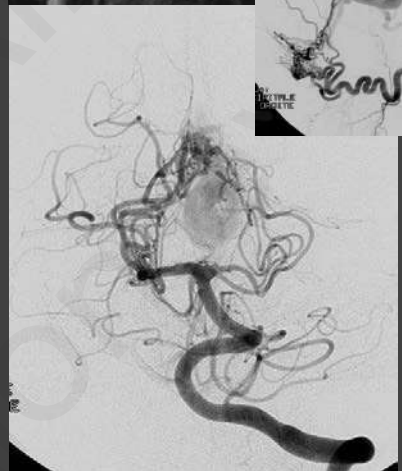
Long circumferential a
Anterior choroidal a
Posterior choroidal a
Chor br of ACA
Limbic circle
Subependymal a
Medial vein of prosencephalon
Epsilon aspect of deep drainage
Falcorial sinus

Dural AVFs

Dural feeders
(MMA, APhA, occip a,
Sup cerebellar,
PCA, ICA…)
VG
Veins of the region







Brainstem AVMs: Rare lesions (2-6% of all brain AVMs)
Tectal plate AVMs?

Rare and small (**surgical**) series of brainstem AVMs

Drake 1986	15 pts	7 « midbrain » (but no precision of localization)	series about PF AVMs: 61/66 Hb
Solomon & Stein 1986	12 pts	4 « tectal plate *region* »	all Hb
Yasargil 1988	14 pts	9 « dorsal/dorsolateral mesencephalon »	revealing Hb in 6 operated pts no info about revealing sympt in non operated pts

Yasargil brainstem AVMs

There are 6 operated and 8 unoperated cases in the present series.

Three of the operated cases were in the dorsal mesencephalon. Two of these were small and located around the left superior colliculus. The third was located within the pineal body. In these cases a hematoma had developed a plane of cleavage and extended down towards the habenular commissure. These 3 cases were operated upon successfully and the only residual deficit was a temporary Parinaud's syndrome in one case (No. 1, 2, 3, Table 4.132, Figs 4.174 and 4.175 in Vol. IIIB, see also Figs 3.31, 3.32 and 3.100, Vol. IIIA). It is interesting to note that these AVMs were barely seen on preoperative angiography and were identified by the early appearance of a dorsal mesencephalic vein.

Three other cases were in the dorsolateral mesencephalon

One case (No. 6, Table 4.132) was unusual, as multiple AVMs were present around the mesencephalon,

In 2 further cases the AVM was in the right paracollicular area involving the nerves IV and V, but fortunately epipial and partially subpial. The feeders were coagulated until the draining vessels turned to dark blue then the lesion was removed. The postoperative course was uneventful in both cases

Out of 189 patients with deep central AVMs, 153 have been operated and 36 not operated. In 6 patients with parasplenial, 4 with callosal, 1 with trigonal-plexal and *3 with dorsal mesencephalic* AVM, the lesions could have been surgically removed but the patients or their relatives refused surgery.

Of nonoperated patients, a total of 19 underwent irradiation

Table 7.6 Statistical data in 20 nonoperated patients who died

13.	K	15	M	1982	Bl	L trunco-thal.	Mod.	Inoperable	2nd Bl	8 mo	16 yrs
14.	K	46	M	1968	Bl	L trunco-thal.	Mod.	Inoperable	2nd Bl	2 yrs	47 yrs
15.	R	32	F	1979	Bl	Intr. mesenc.	Mod.	Inoperable	Radiation in Boston, 2nd Bl	6 yrs	38 yrs

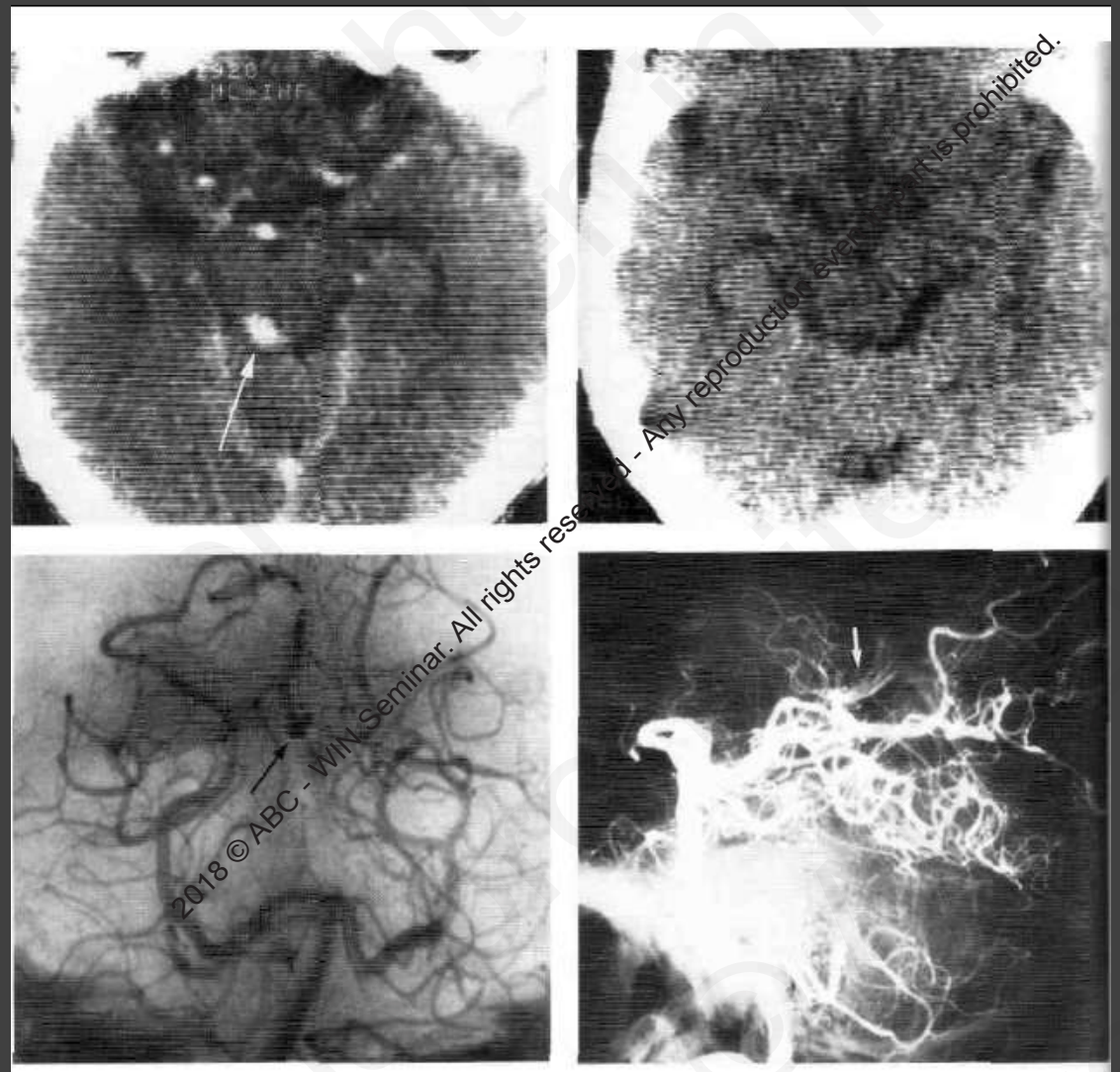


Fig3.31A-D
A A 60 year old male patient presented with subarachnoid hemorrhage and Parinaud syndrome had a small enhancir: nodule located over the left superior colliculus shown on CT (white arrow). B Postoperative CT 2 months after removal of the lesion. **C-D** Frontal and lateral vertebral angiography showed a barely visible nidus (black and white arrow) with draining veir On lateral vertebral angiography only early filling of the v. Galen and the straight sinus was seen. The 5 x 5 mm AVM was explored and removed through a supracerebellar approach. No additional neurological deficit after operation. Total disappearance of Parinaud syndrome within 6 months.

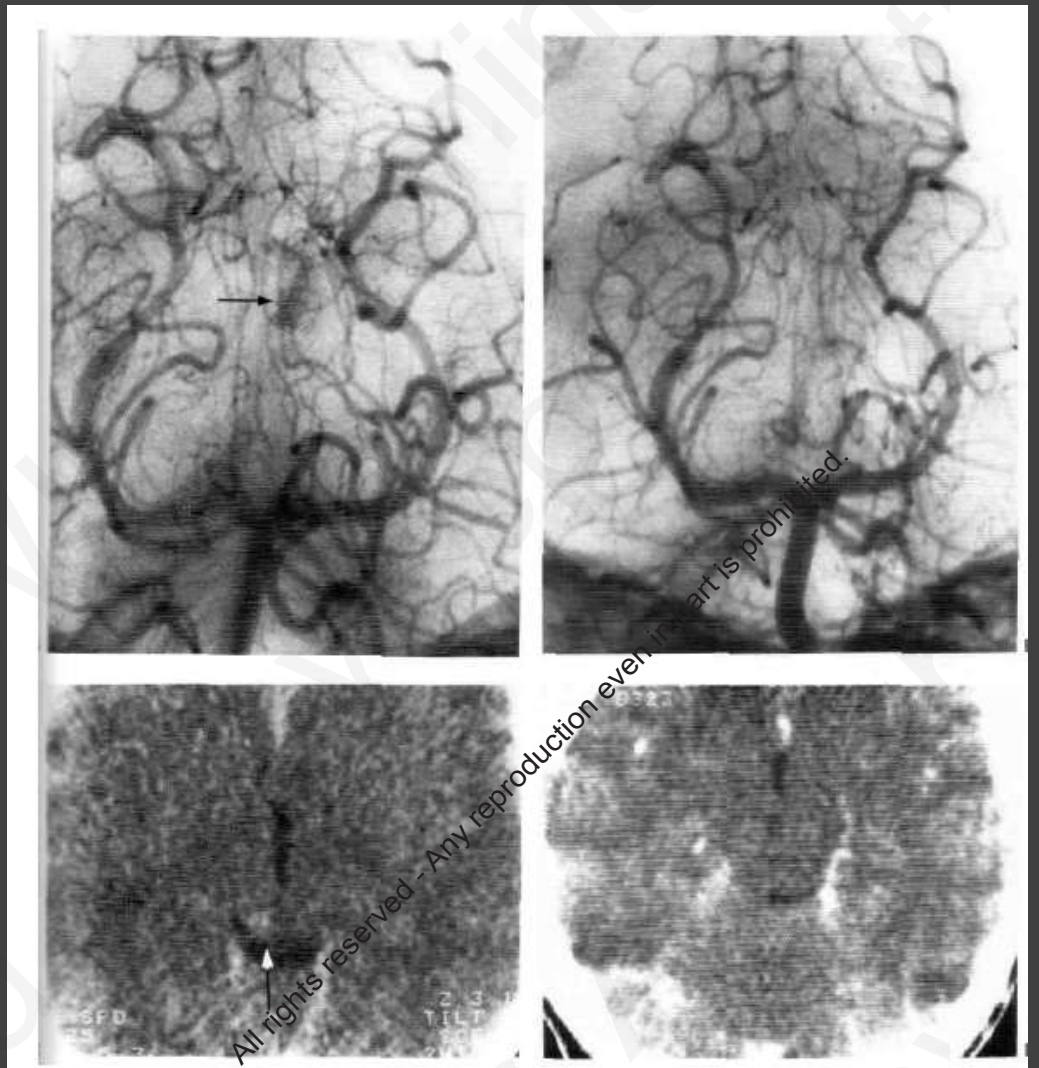


Fig 3.32A-D This 14-year old boy had subarachnoid hemorrhage.
A Carotid and lateral vertebral angiography were normal. AP vertebral angiography showes a small nidus with an early draining vein located over the left dorsal mesencephalon (arrow). Surgery confirmed a small AVM located over the left superior colliculus. The AVM was radically removed.
B Postoperative vertebral angiography.
C Preoperative CT showed a small enhancing lesion in the area of the left superior colliculus (arrow).
D The postoperative (CT) showed no parenchymal defect in the mesencephalon. The postoperative course was uneventful. No Parinaud syndrome.

Yasargil

Brainstem AVMs: Rare lesions (2-6% of all brain AVMs)
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Lawton & Spetzler 1995 Spetzler & Martin 1986	10 pts	NA	
Nozaki 2006	25 pts	9 « dorsal midbrain »	9 initial Hb. 3 repeated Hb
Kelly & Steinberg 2008	29 pts	NA	
Han & Lawton 2015	29 pts	6 « posterior midbrain »	Hb in 23 pts (79,3%)
Madhugiri & Steinberg 2017	39 pts	11 « posterior midbrain »	Hb in 36 pts (92,3%)

Haemorrhage SAH / IVH

No precise information about the annual hemorrhagic rate of tectal AVMs

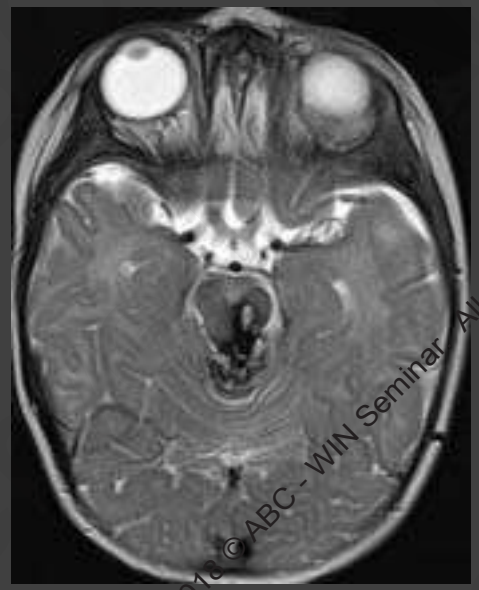
Annual Hb risk Brainstem AVMs 15,1% - 17,5%

Koga 2011, Nozaki 2006, Han 2015, Madhugiri 2017

Annual Rebleeding risk Brainstem AVMs 14,2%

Nozaki 2006

Intraparenchymatous

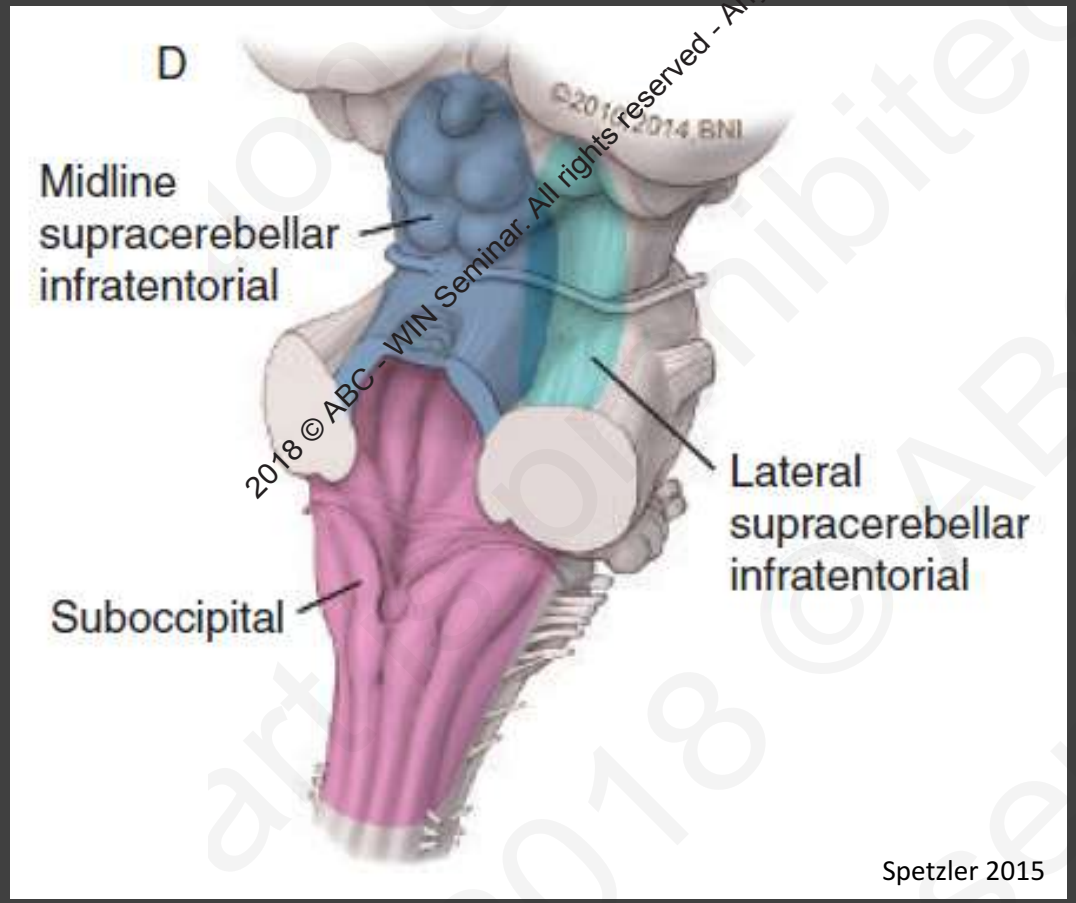


Severe Neurological Symptoms

- somnolence –> coma
- III IV palsy
- ataxia
- hemiparesis
- hemihypoesthesia
- vertical gaze palsy
- cerebellar syndrome
- auditory troubles
- …

Posterior fossa AVMs

75-95% cerebellar
5-25% brainstem *Drake 1986; George 1992; Spetzler 2015*

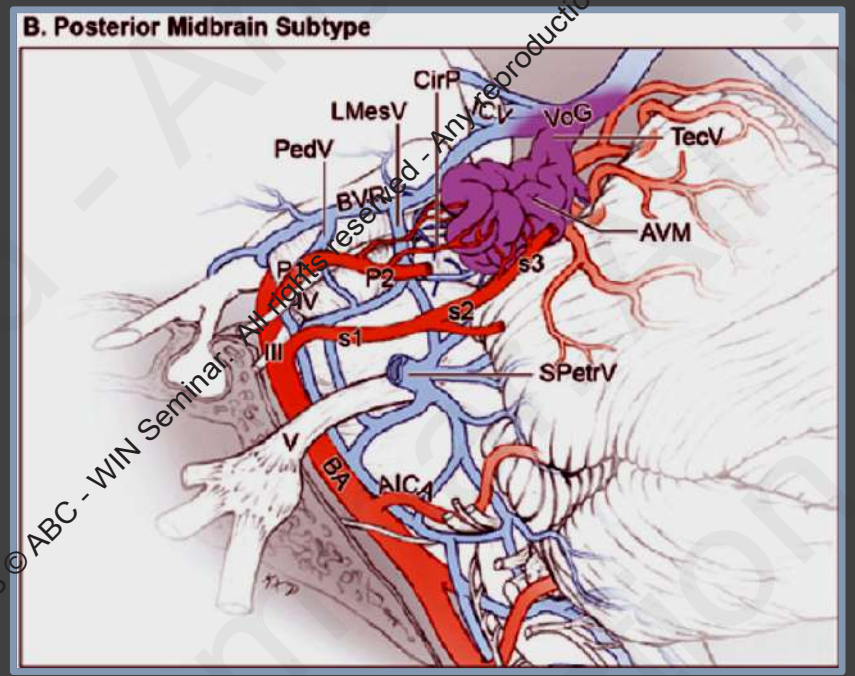


The supracerebellar infratentorial approach is usually used for AVMs of the tectal plate and the superior surface of the cerebellum, provided they do not extend above the incisura (need for a posterior interhemispheric approach)

Solomon RA and Stein B; Neurosurgery 1986
Han SJ and Lawton M; J Neurosurg 2015

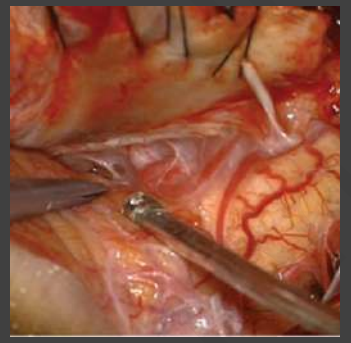
Occipital interhemispheric transtentorial approach

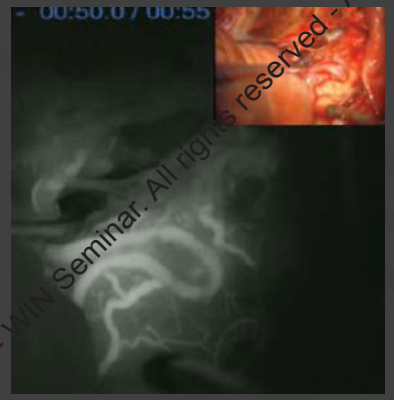
Mc Laughlin N and Martin NA; World Neurosurg 2014



Clinical & morphological outcomes after therapeutic management (brainstem! Tectum?)

Surgery





Han&Lawton
Example of OP lateral medullary AVM

Better outcome if epipial than subpial

Total excision vs retrograde venonidal microsurgical obliteration

Steiger HJ, Hänggi D 2009

« occlusion in situ technique »

Han & Lawton 2015,
Madhugiri & Steinberg 2017
(already Yasargil 1988…)

* Postsurgical outcome influenced by presurgical condition
* Rate of worsening/death greatest with posterior midbrain and anterior pontine AVMs

Han & Lawton 2015

* Post surgical permanent complication rate is 13,8-25%

Han & Lawton 2015
Nozaki 2006

Rare and small (**endovascular**) series of brainstem AVMs

A midbrain arteriovenous malformation at quadrigeminal plate completely obliterated by embolization

Nakahara & al; No Shinkei Geka 1993

18 y male. Hb => tetraparesis. Recovery 6 months with residual R hemisensory disturbance and Parinaud
2 sessions of E° with EVAL after provocative tests (Amytal and Xylocain). Left oculomotor nerve palsy. Cure of AVM

Endovascular treatment of brainstem arteriovenous malformations: safety and efficacy

HM Liu & al, Neuroradiology 2003

1 dorsal midbrain	Hb
1 central and dorsal midbrain	Hb
1 pulvinar and dorsal midbrain	Hydrocephalus

All transmesencephalic feeders
All intranidal AA

E° glue	partial treatment (2x 75% occlusion, 1x 90% occlusion)
	FU outcome: 2x good, 1x fair

Rare and small (**endovascular**) series of brainstem AVMs

A proposed grading system to evaluate the endovascular curability of deep-seated arteriovenous malformations

Th. Robert & al; J Neurol Sci 2017

5 groups. Group 5: midbrain (no specificity of anatomical area : centered in midbrain: N=15)

10 E°. 3 Cured

Radiationtherapy in others

A challenging entity of endovascular embolization with Onyx for brainstem arteriovenous malformations. Experience from 13 cases

Jin H &al; Interv Neuroradiol 2017

9 posterior midbrain AVMs.

8 Hb. 1 Headaches

1 intranidal AA on feeder

2 cured by E°. 7 partial E° + additional GammaKnife

No complication in the 2 cured pts and in 3 partially treated pts

1 death (brainstem infarction)

1 Hb with poor outcome (mRs 3)

2 transient diplopia (mRs 0 and 1 at mean FU 45,3 months)

More publications about **radiosurgery** and brainstem AVMs … but rare specificity about tectal AVMs…

Microsurgery and radiosurgery in brain arteriovenous malformations

Steiner L & al; J Neurosurg 1993

57 brainstem AVMs (tectum?)
Complete obliteration in 71,4% of pts after 2 years FU
But no information about clinical characteristics , treatment parameters and adverse events

Prediction of results following Gamma Knife surgery for brain stem and other centrally located arteriovenous malformations: relation to natural course.

Karlsson B & al; Stereotact Funct Neurosurg 1996

Centrally located lesions carry higher risks of complications than those located peripherally
Positive relationship between the minimum dose given to the AVM nidus and the incidence of obliteration
The average dose to volumes that are large for radiosurgery is related to the incidence of complications

Results of radiosurgery for brainstem arteriovenous malformations

Kurita H & al; JNNP 2000

“Radiosurgery is considered as a valid treatment (…) it is also known to cause serious neurological deterioration when used for brainstem lesions”
“(…)the treatment of choice for brainstem AVMs located within the parenchyma”
“post treatment hemorrhage remains a significant problem with this technique…”

10 tectal AVMs

No description of the outcome of this specific type of brainstem AVMs, but :
“two patients with midbrain AVMs experienced symptomatic radiation injury 7 and 24 months after irradiation: ptosis and ataxia in one, eye movement disorder in the other one”
⇒ steroids. Resolution of symptoms within 1 year. No permanent deficit related to radiosurgery

GammaKnife radiosurgery for brainstem arteriovenous malformations: preliminary results

Massager N & al, J Neurosurg 2000

2 tectopineal AVMs
Overall results with no focus on the specific lesions

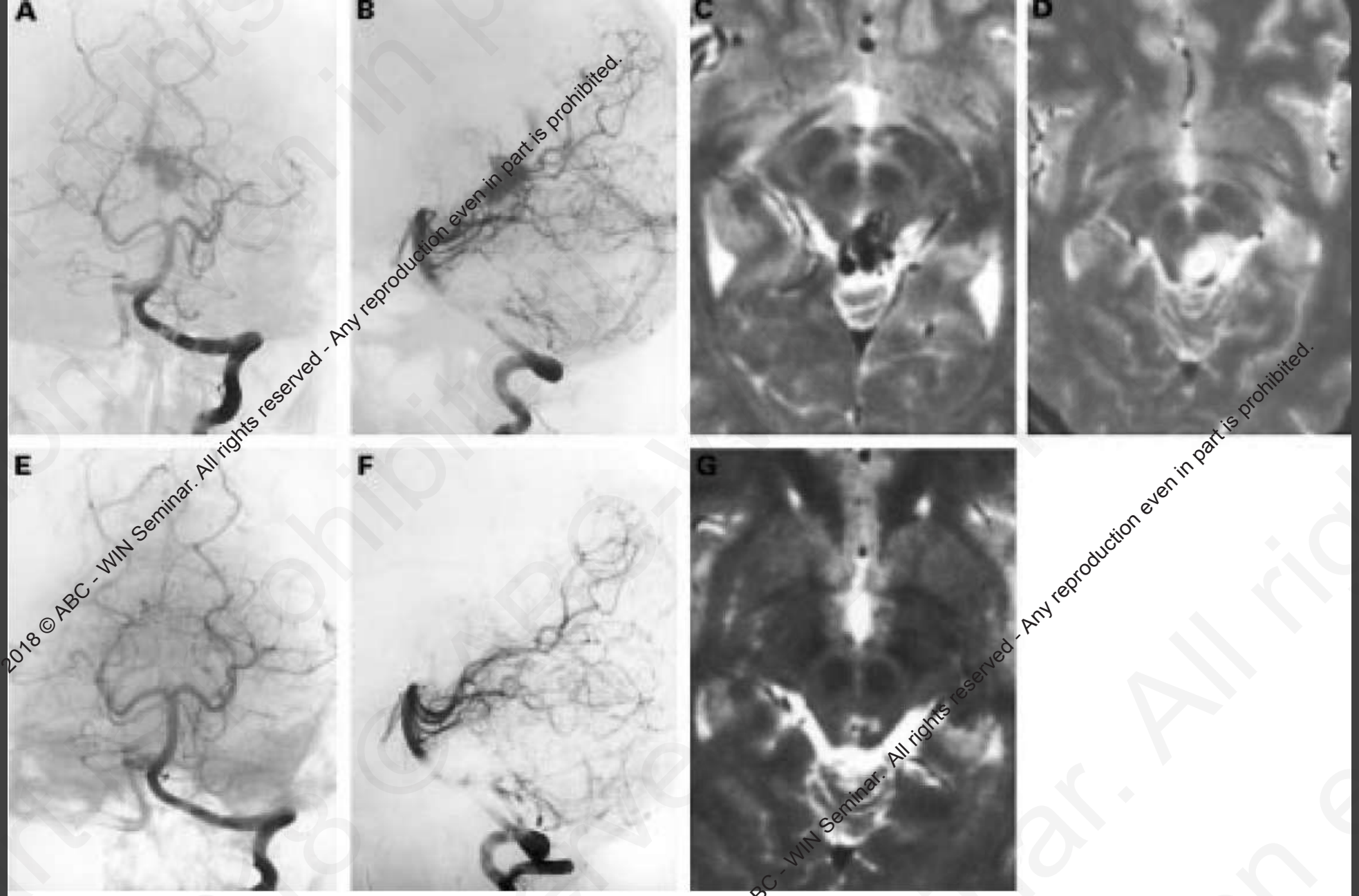


Figure 3 Neuroimages in a 16 year old girl with intraventricular haemorrhage. Left vertebral angiograms (A, B) and T2 weighted MR image (C) before radiosurgery show ruptured AVM in the tectum. T2 weighted MR image (D) obtained 6 months after radiosurgery shows asymptomatic brain stem oedema. Left vertebral angiograms (E, F) and T2 weighted MR image (G) obtained a year after radiosurgery show total obliteration of the AVM and a reversal of the oedema.

Kurita & al
JNNP 2000

Stereotactic radiosurgery for brainstem arteriovenous malformations: factors affecting outcome

Maruyama K & al, 2004

An older patient age, a lesion located in the tectum, and a higher radiosurgery-based score were significantly associated with greater neurological complications

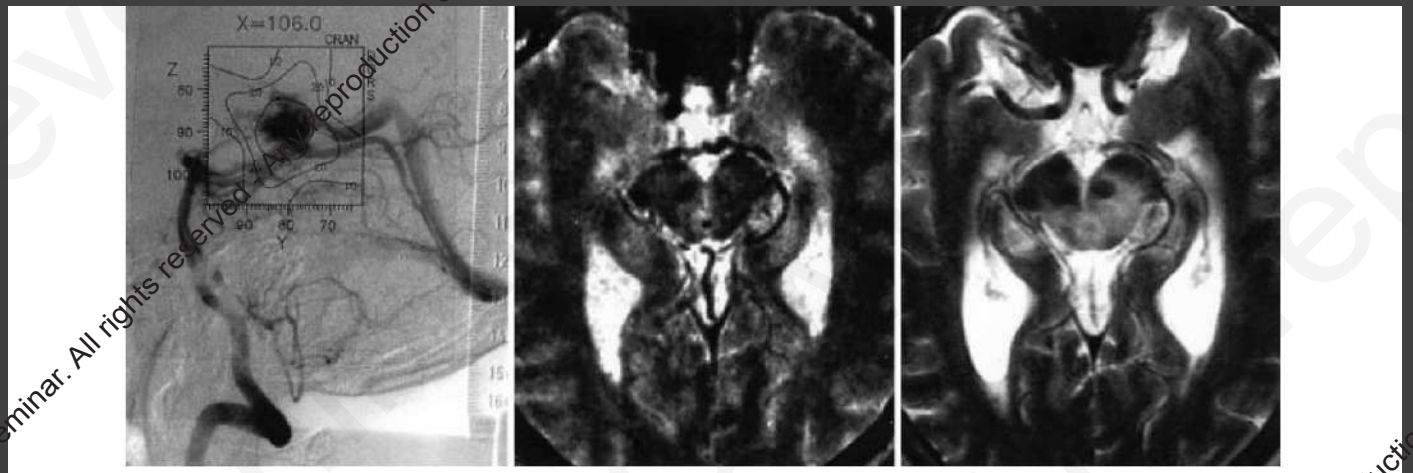


FIG. 4. Stereotactic vertebral artery arteriogram *(left)* and MR image *(center)* obtained in a 63-year-old patient, demonstrating a tectal AVM. A T_2-weighted MR image *(right)* obtained 28 months after radiosurgery (margin dose 20 Gy), revealing adverse radiation effects.

Stereotactic Linac based radiosurgery in the treatment of arteriovenous malformations located deep involving corpus callosum, motor cortex or brainstem

Zabel-Dubois A & al Int. J. Radiation Oncology Biol Phys 2006

5 brainstem AVMs (localization?)

« Size of AVM and applied single dose were determined as significant factors affecting successful obliteration »

Stereotactic Linac based radiosurgery in the treatment of arteriovenous malformations located deep involving corpus callosum, motor cortex or brainstem

Tabel-Dubois A & al Int. J. Radiation Oncology Biol Phys 2006

5 brainstem AVMs (localization?)
« Size of AVM and applied single dose were determined as significant factors affecting successful obliteration »

GammaKnife Radiosurgery for arteriovenous malformations of basal ganglia, thalamus and brainstem- a retrospective Study comparing the results with that for AVMs at other intracranial locations

Kiran NA & al; Acta Neurochir 2009

« Central AVMs »….
No distinction of type of lesions and localization
Only size and dose…

Javalkar V & al, Neurol India 2009 Effective modality of treatment for central AVMs

Yen CP and Steiner L World Neurosurg 2011 42 midbrain AVMs
« When the risks of surgery or embolization are high or there are still patent AVMs, GKS should be considered as a treatment alternative if the nidus is located in the subpial or epipial area,and it should always be used when the nidus is deep in the parenchyma of the brainstem.
In the present series, GKS achieved a complete obliteration rate of 59%. To this result should be added the higher risk of radiation-induced complications. »

Stereotactic radiosurgery for arteriovenous malformations located in deep critical regions

Nagy G & al, Neurosurgery 2012

After single treatment, obliteration was achieved in 65% of the brainstem, in 69% of the supratentorial, and 40% of the peritectal AVMs. Obliteration of lesions <4 cm was better in the brainstem (70%) and in the supratentorium (80%), but not in the peritectal region (40%).

Management outcome of brainstem arteriovenous malformations: the role of radiosurgery

Yang W & al, World Neurosurgery 2016

"The distribution of brainstem locations in our cohort was 63.3% midbrain…"

Etc …. Etc…

Brainstem….Sometimes mesencephalon…rarely tectal / quadrigeminal plate…

In Foch, Nancy and network

26 pts with quadrigeminal area AVMs	20 Nancy	9 epipial	11 subpial
	6 Foch	4 epipial	2 subpial

Revealing symptoms	22 Hb (84,6%) 1 fortuituous discovery (associated temporal AVM) 3 neuro (gaze palsy/ paresis -> diplopia…)
Feeders	Mostly Collicular a , Superior cerebellar a
Venous drainage	Precentral cerebellar vein / Latero mesencephalic vein (epipial) (More complex venous drainages for subpial lesions)
Associated AA or false AA	1 / 26 (subpial). 0 in epipial
Size of lesion	From punctiform (epipial) to small nidus

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Therapeutic strategies and outcomes

17 pts treated Nancy

E° 20 glue / 1 Onyx

6 pts treated Foch

Trtt in 23 pts/26

1 spont occl
1 abstention
1 waiting for E°

	E° alone	Rx therapy alone		E°+Rxth		Total
Cure (Total occlusion)	6*	1		5**		12
Incomplete occl	6***	1	ReHb 5y . Further Trtt in discussion	2	Further trtt in discussion	9
Waiting for results				2		2
Total	12	2		9		23

* 1 recurrence 10 y later (=> diplopia. 2nd E° + Rxth)

** 1 recurrence 7 y later (=> Holmes tremor. 2nd RXth)

*** 2 early rebleeds at D4 and D10 (1 death; 1 waiting for complementary trtt)
1 pt Onyx. Occlusion Sup cereb a. Development angiogenesis + dural adh (waiting for Rxth)
3 lost FU

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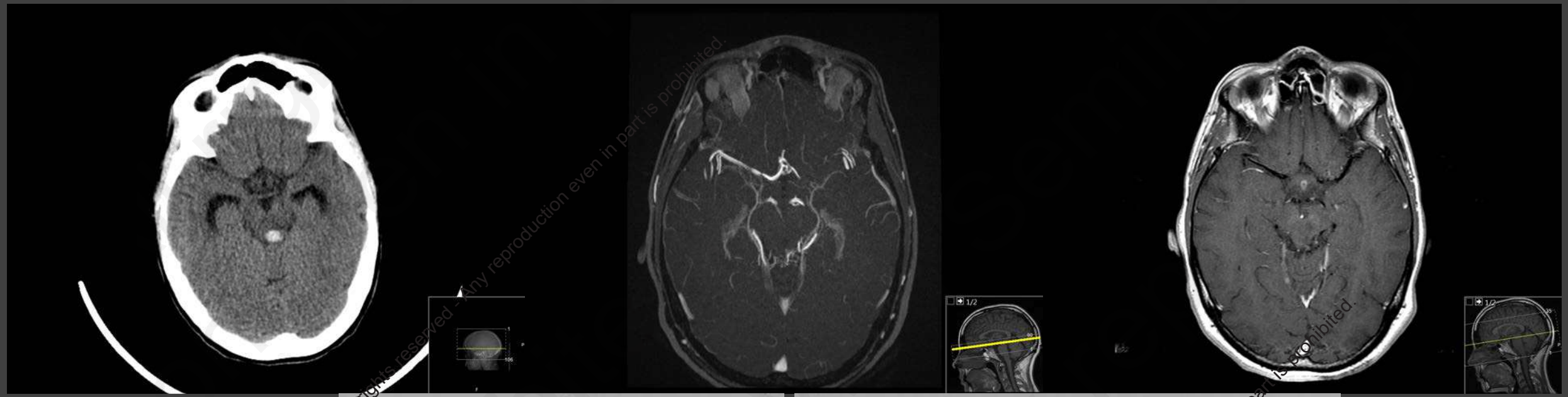
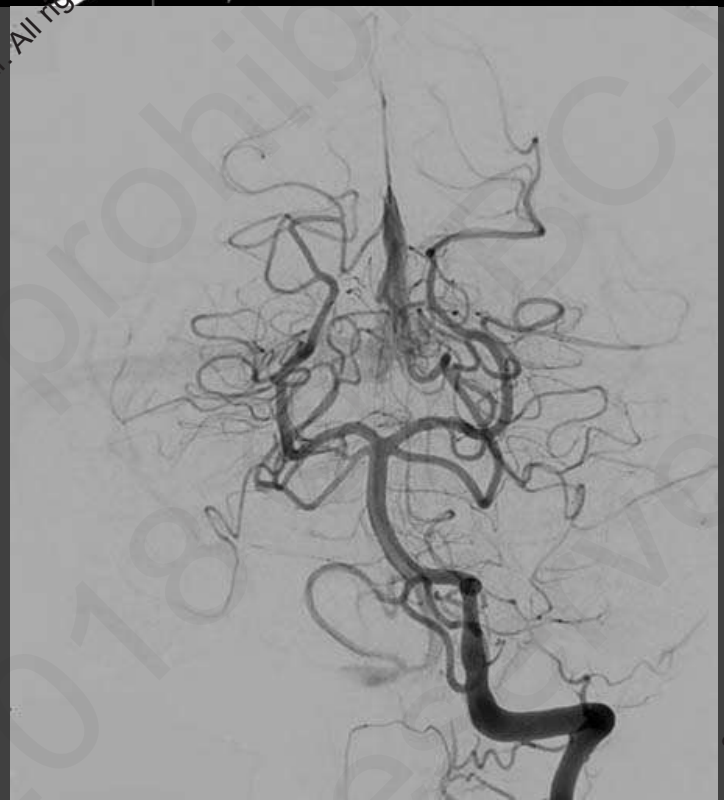
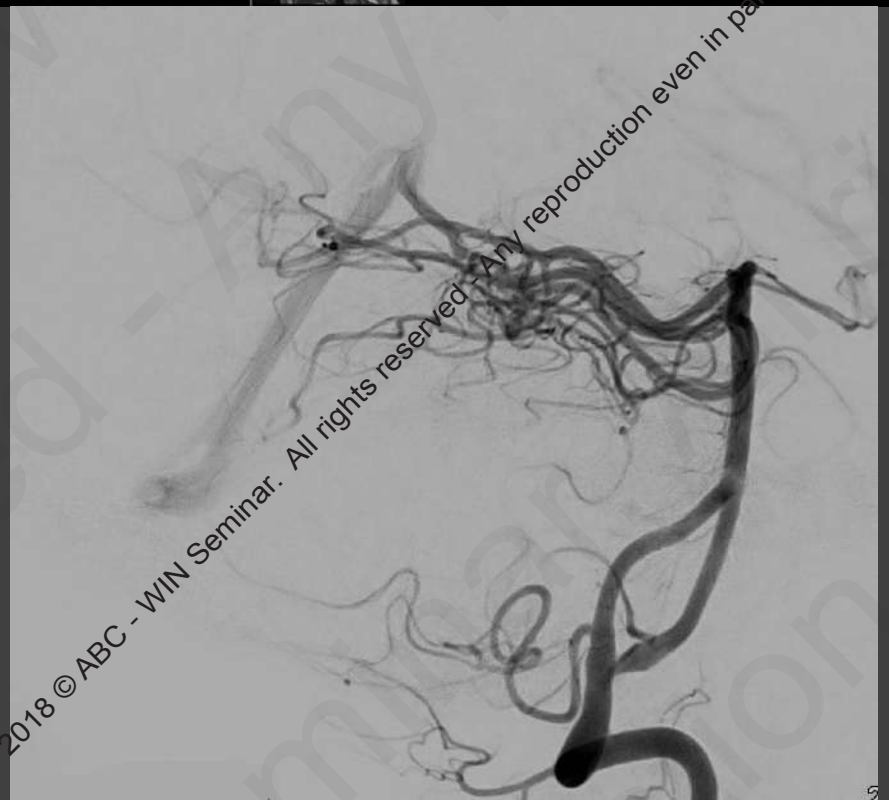


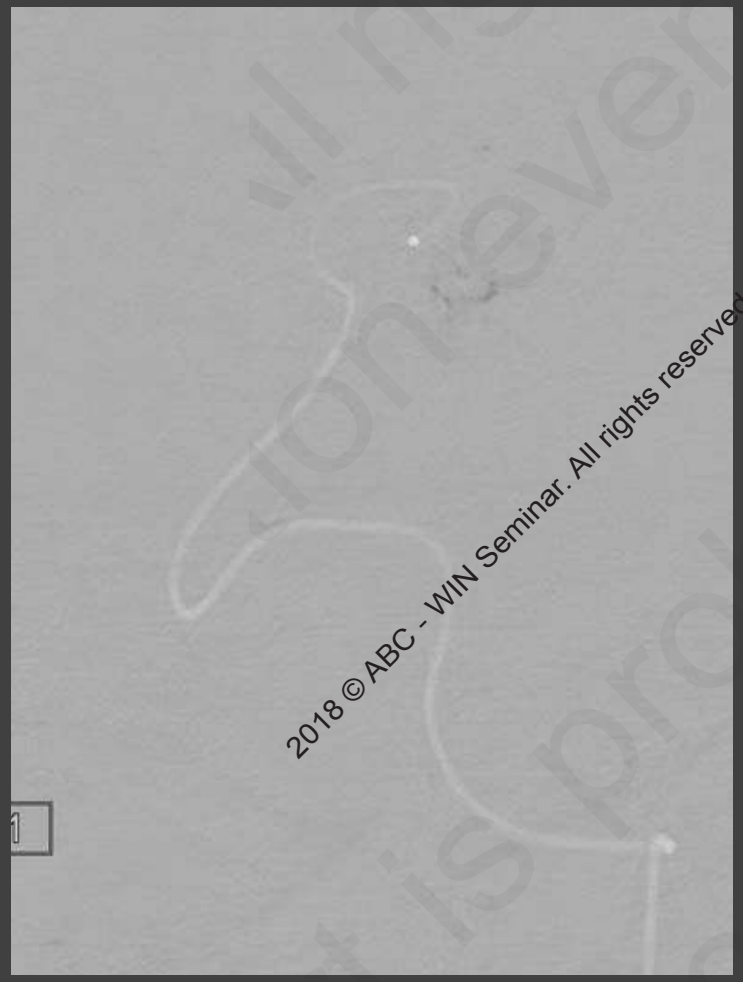


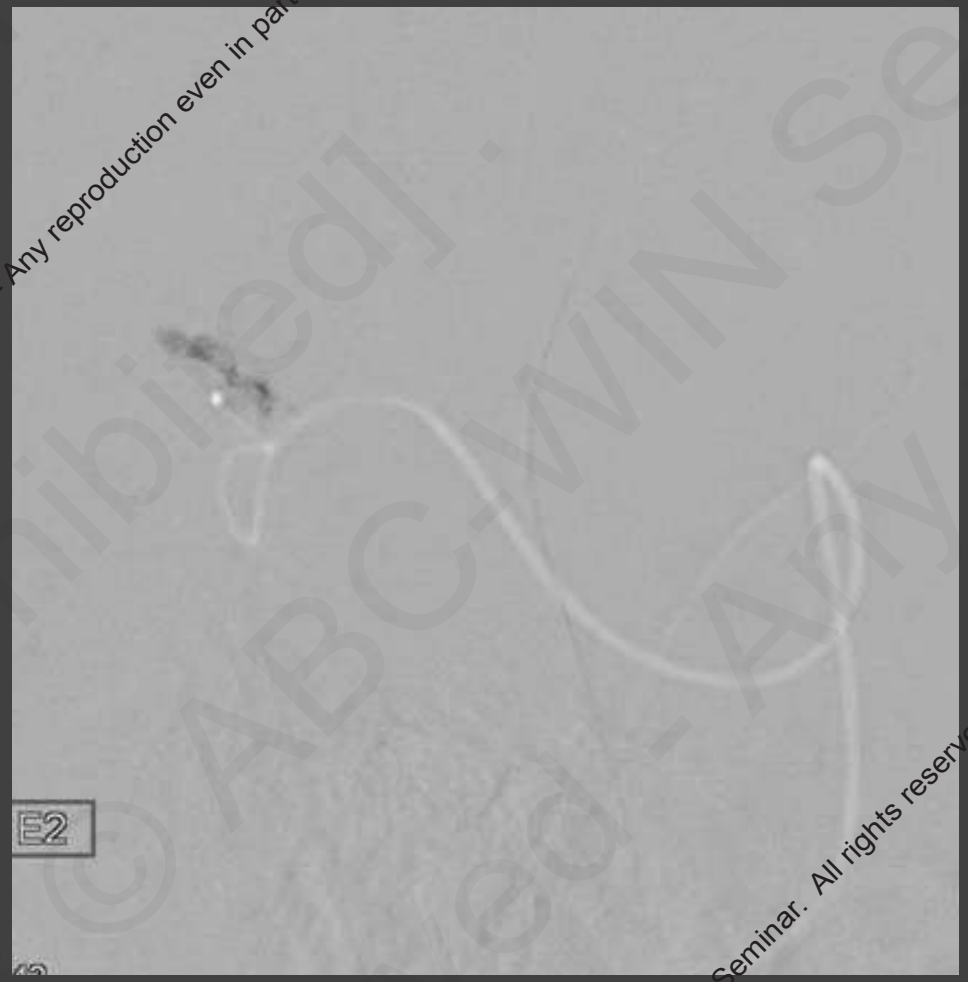


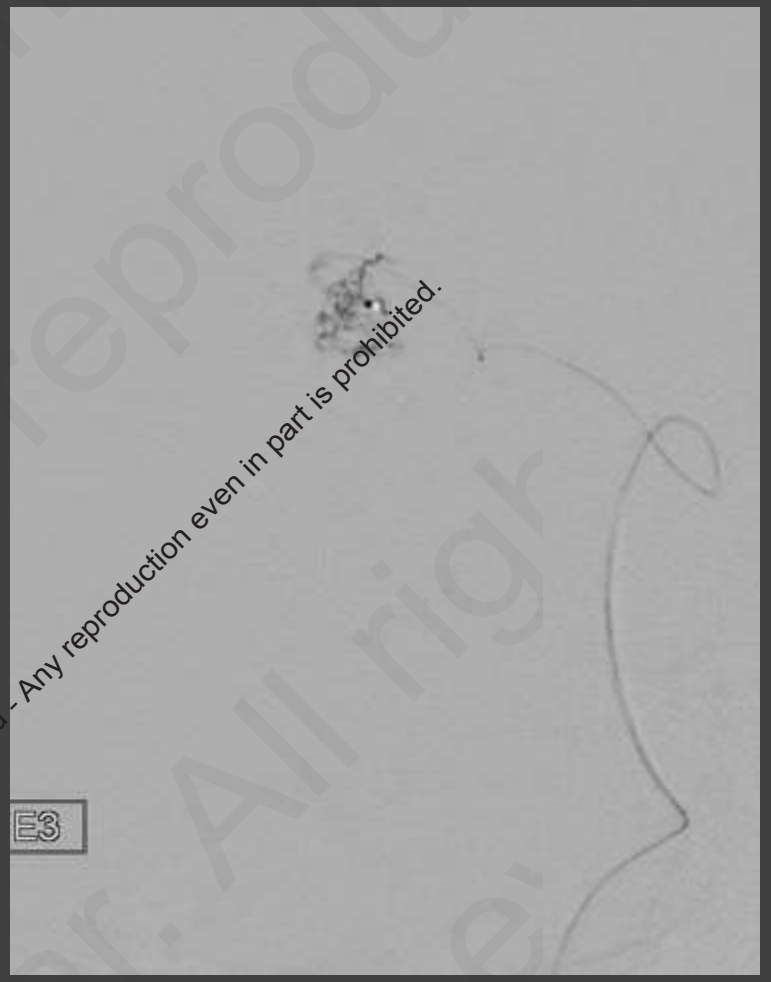
31 y F
Hb 2011
Headaches
Tinnitus
Gaze palsy
R hemihypoesthesia
L hemiparesis

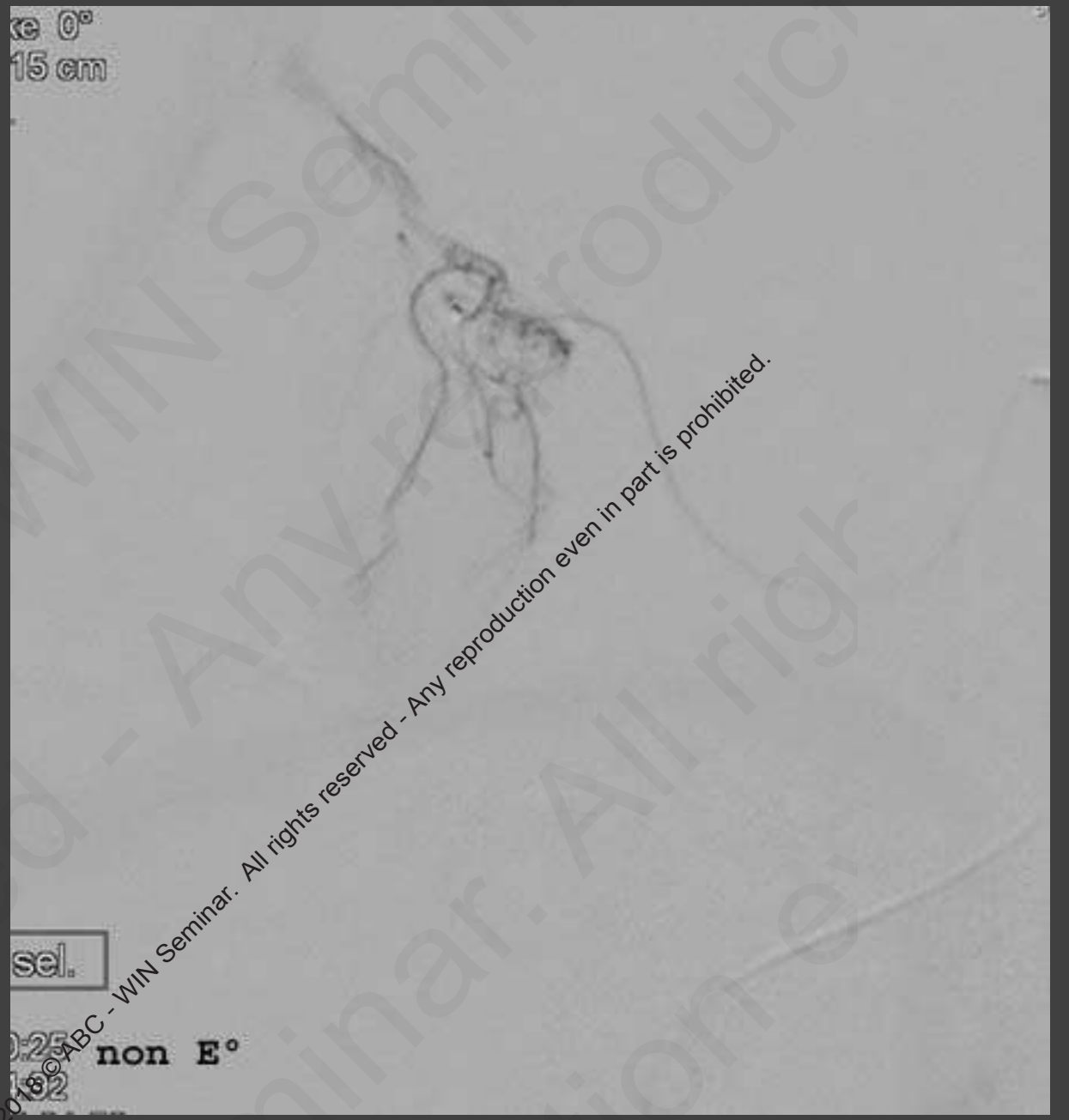
Partial recovery
Diplopia, hypoesthesia
R upper limb

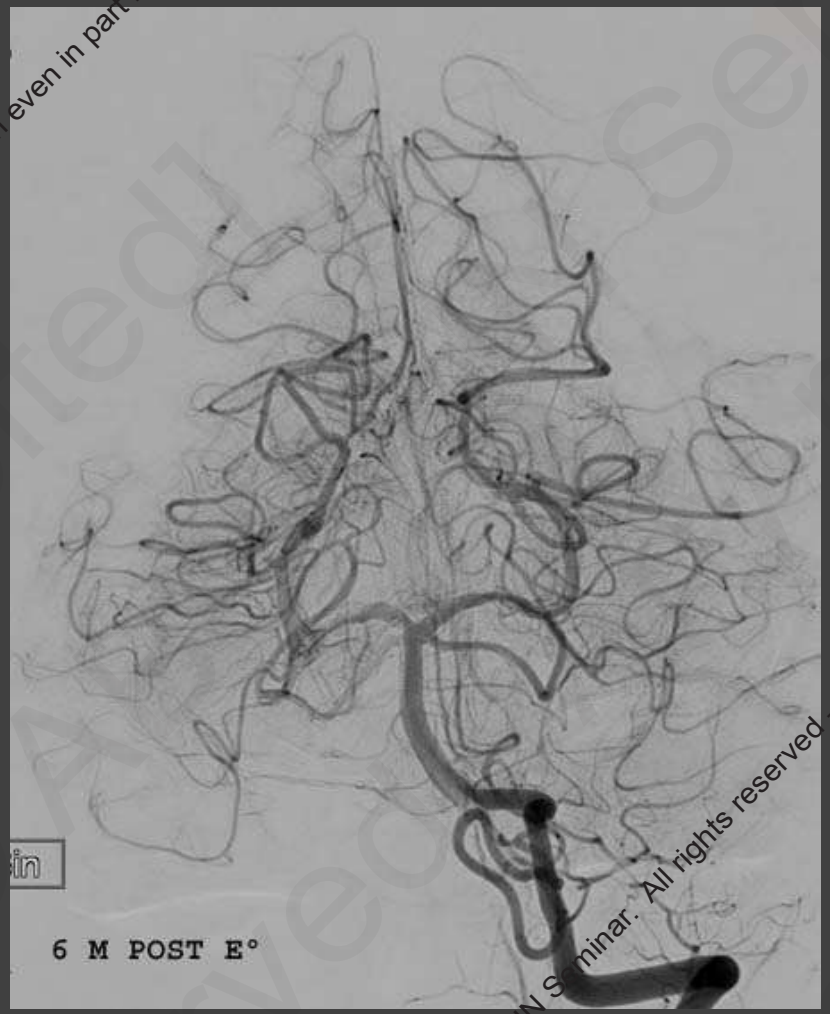
Radiosurgery 2012
->No effect

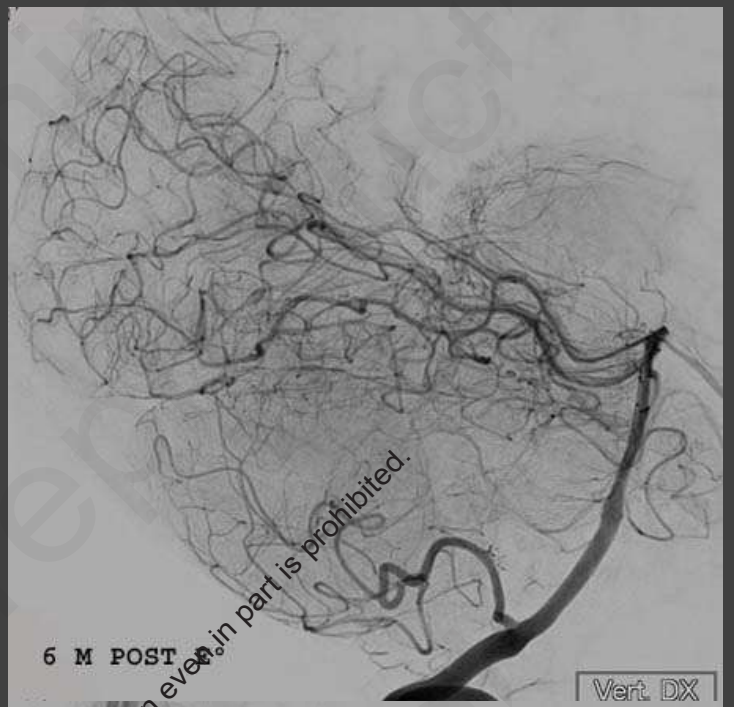


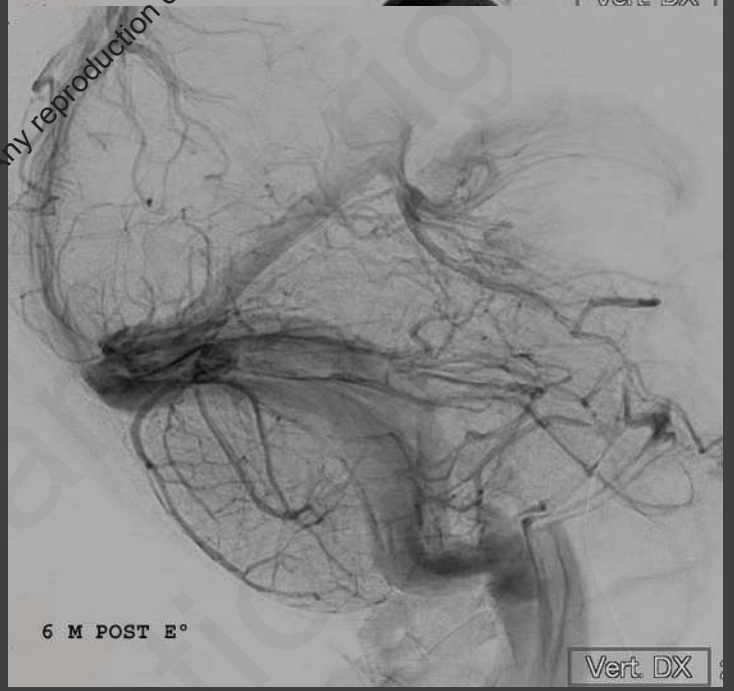




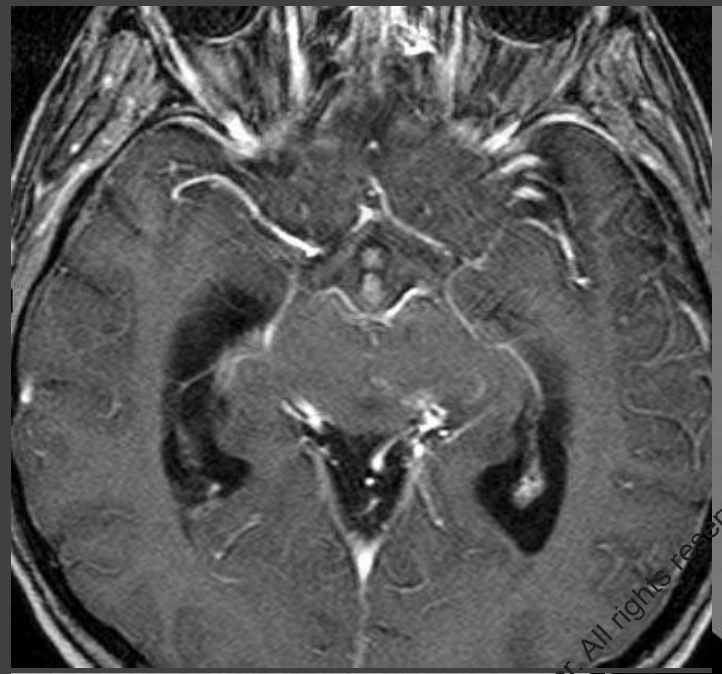


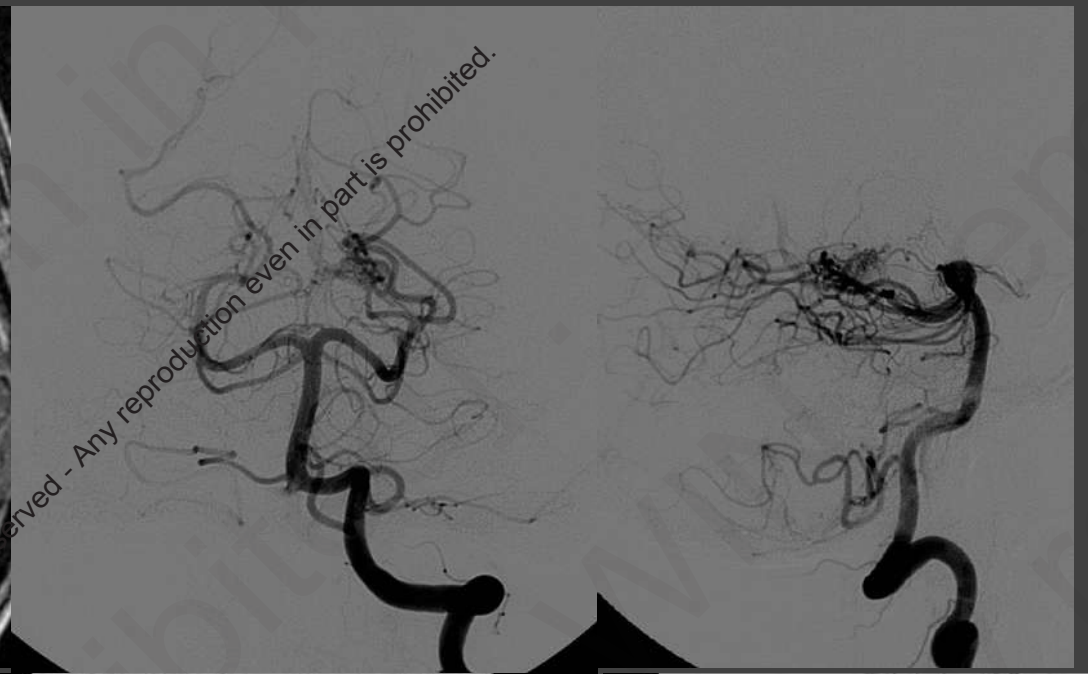


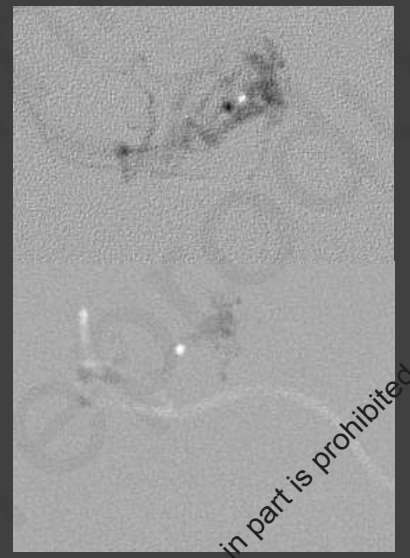




Cure by E° alone



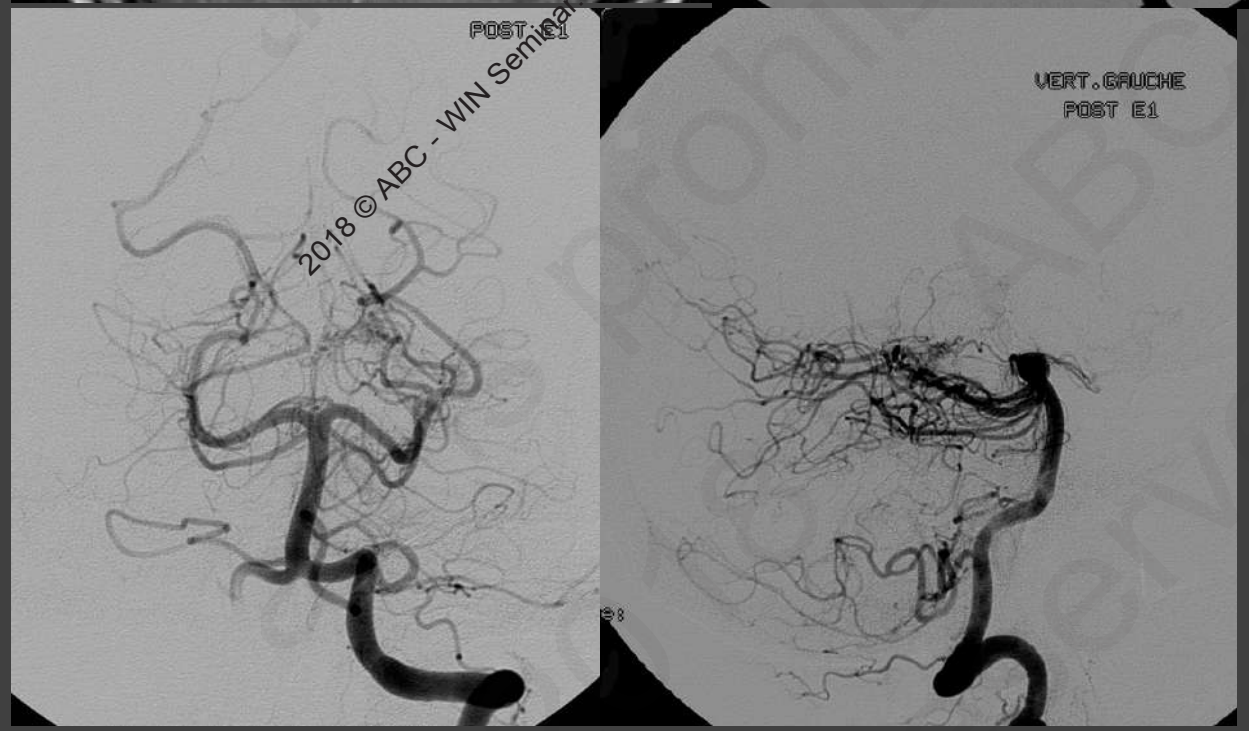


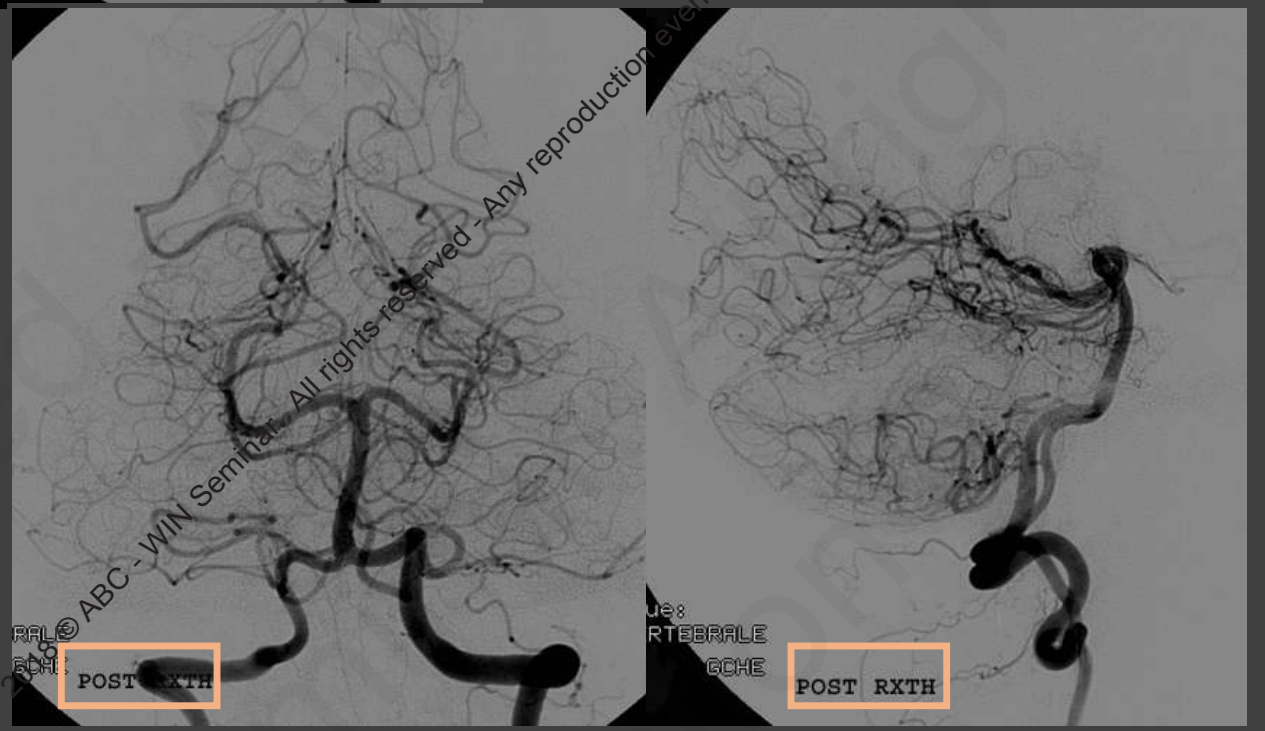


F 49 y

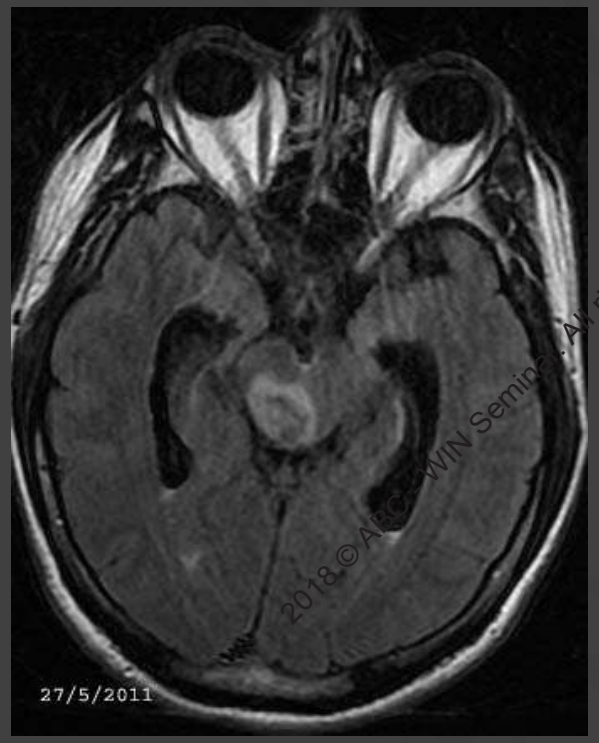
IVH

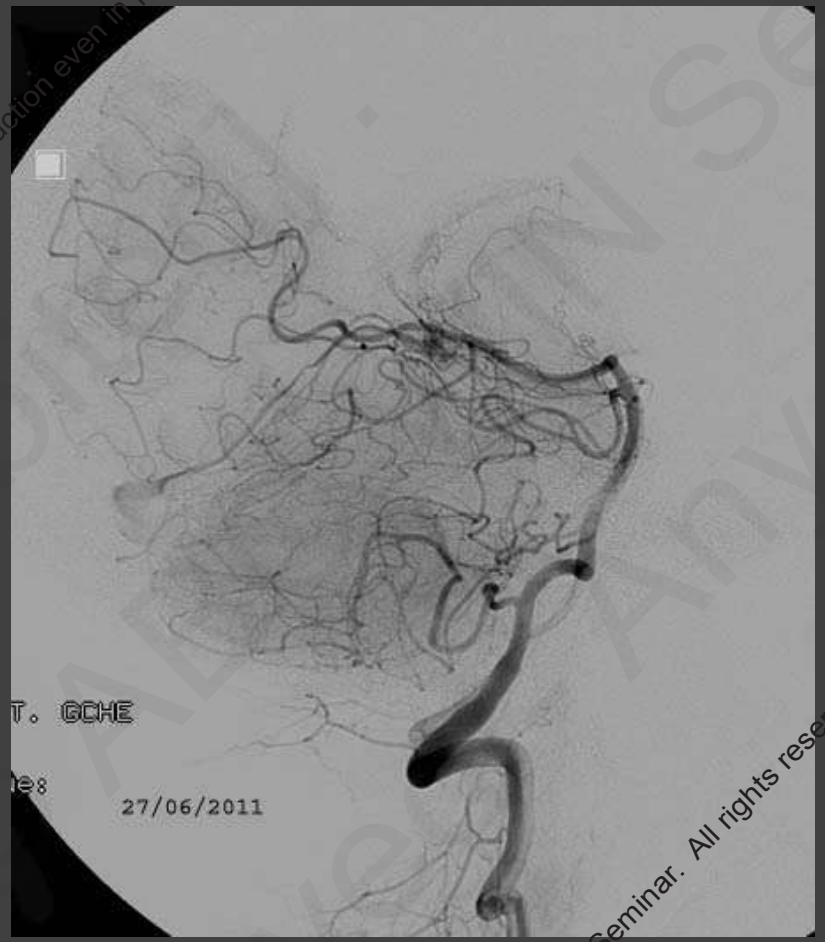
Tr in writing
Hemifacial pain

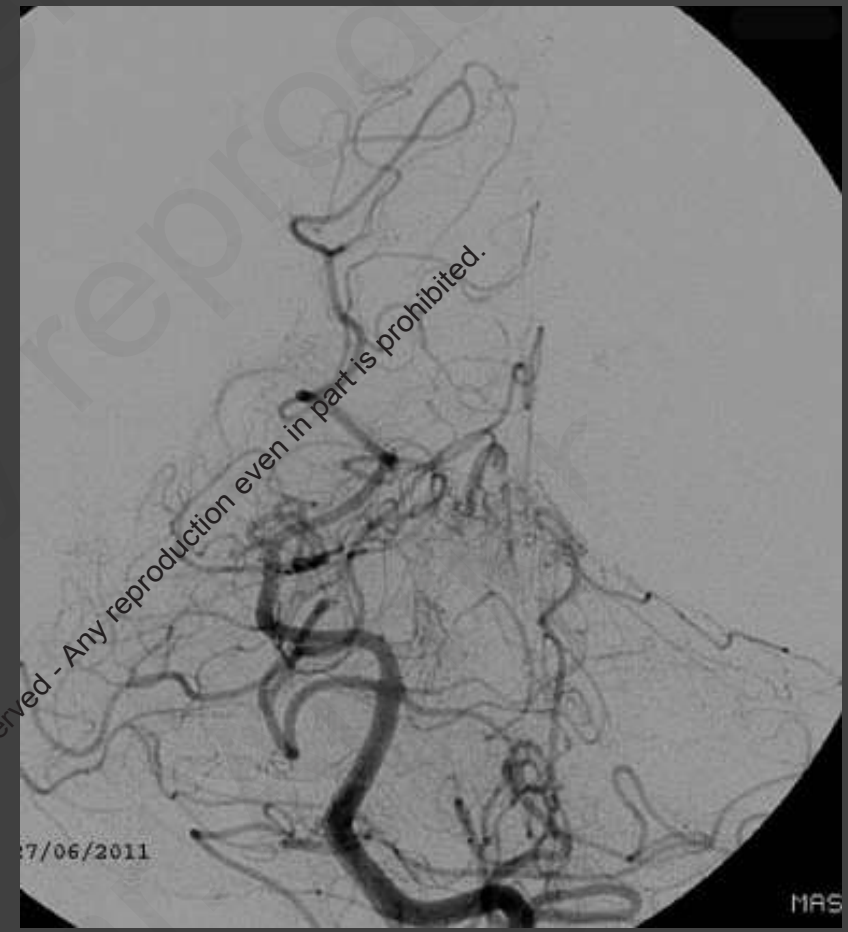


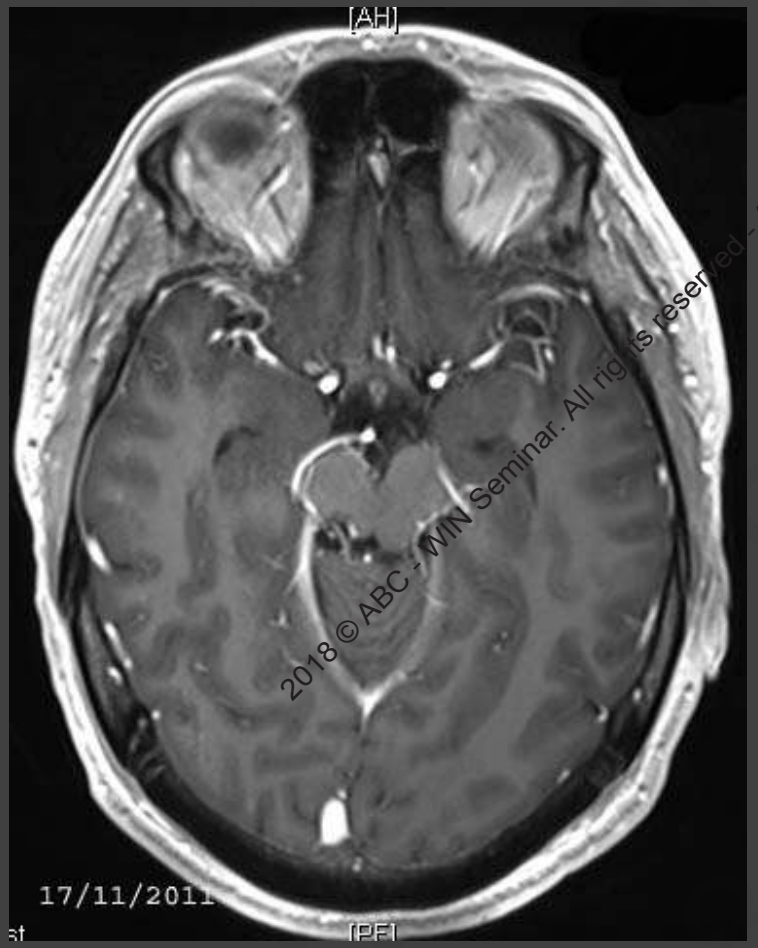


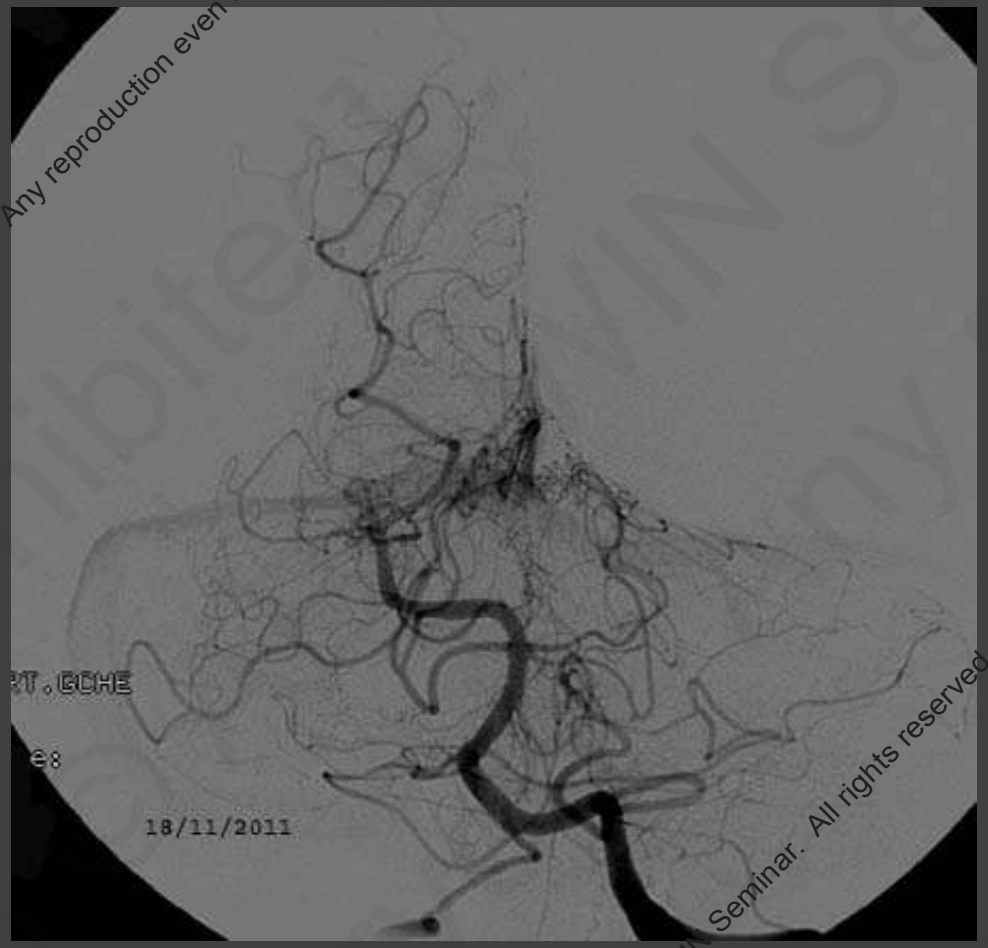
M 41 y
Left hemiplegia
Dysarthria
Oculomotor palsy

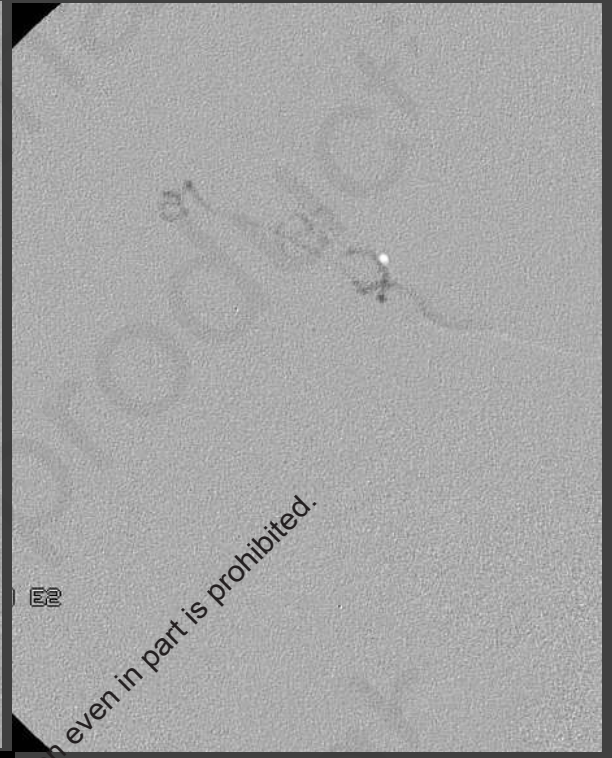


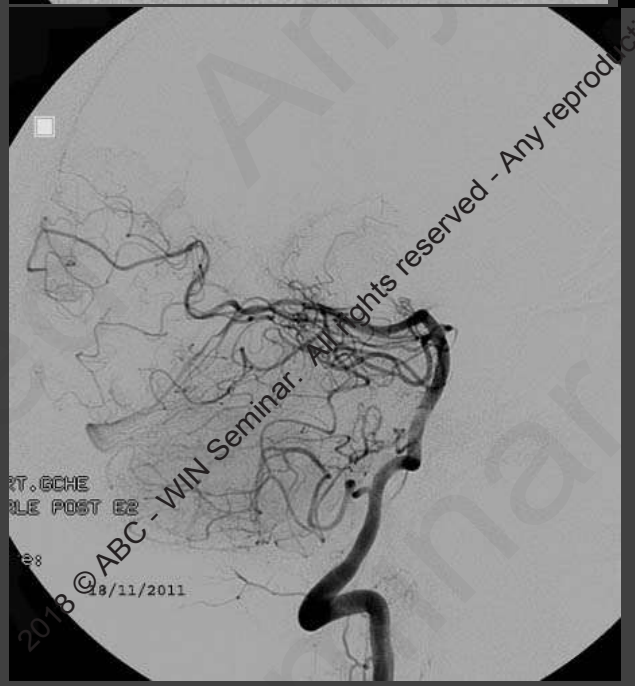


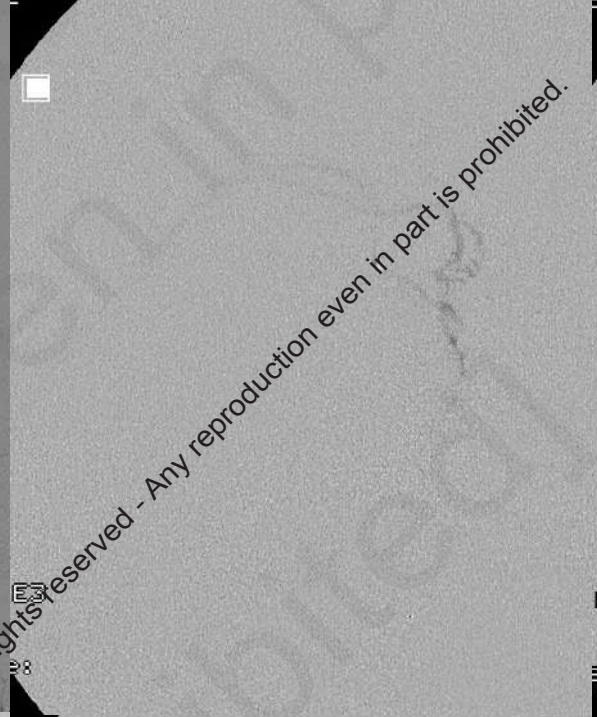


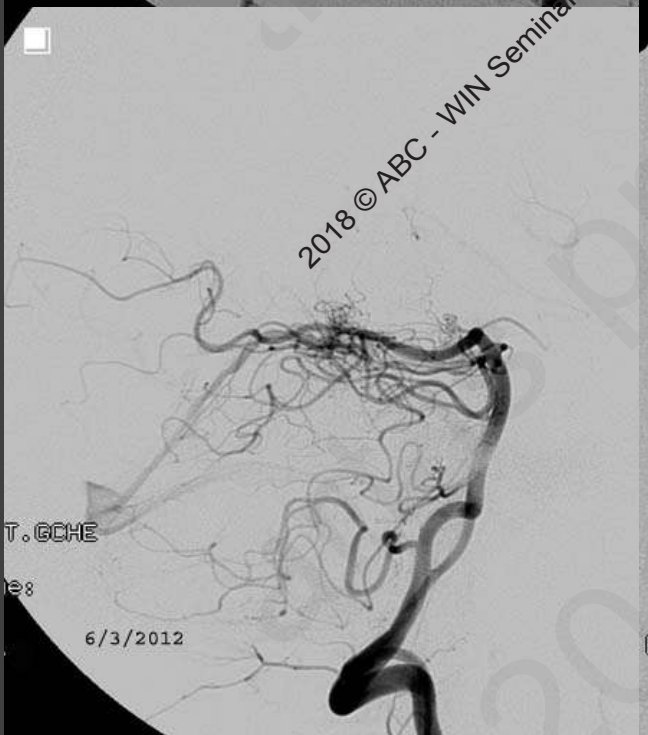


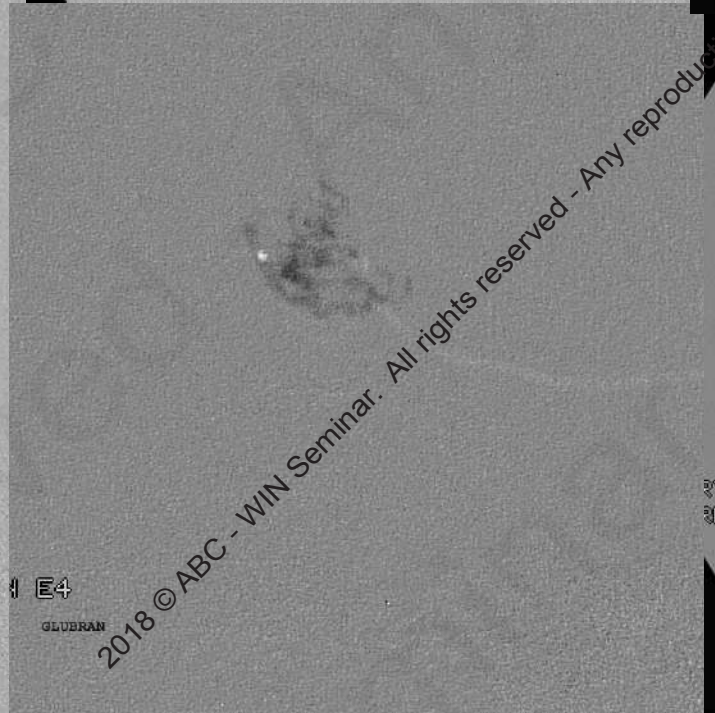


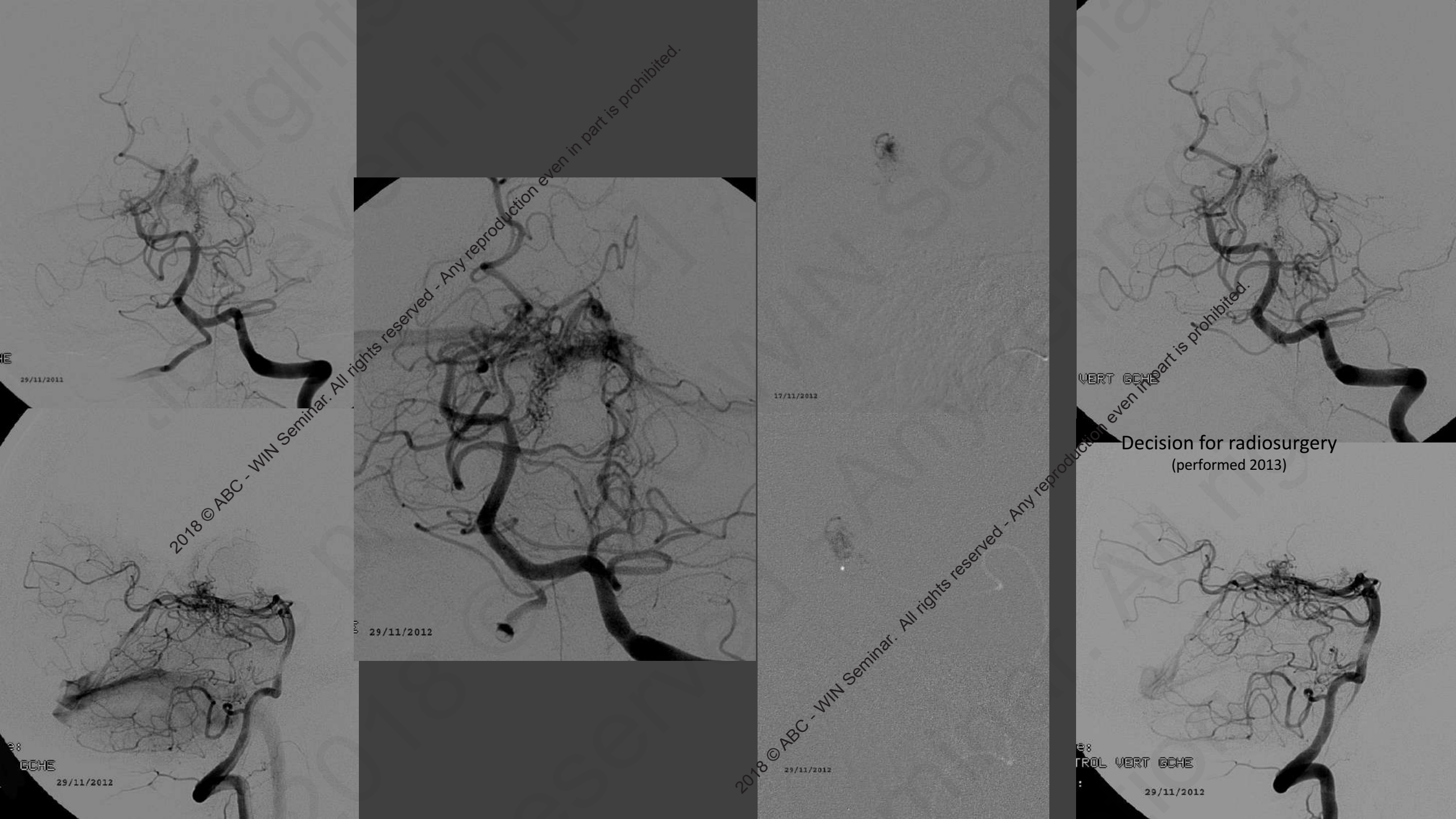




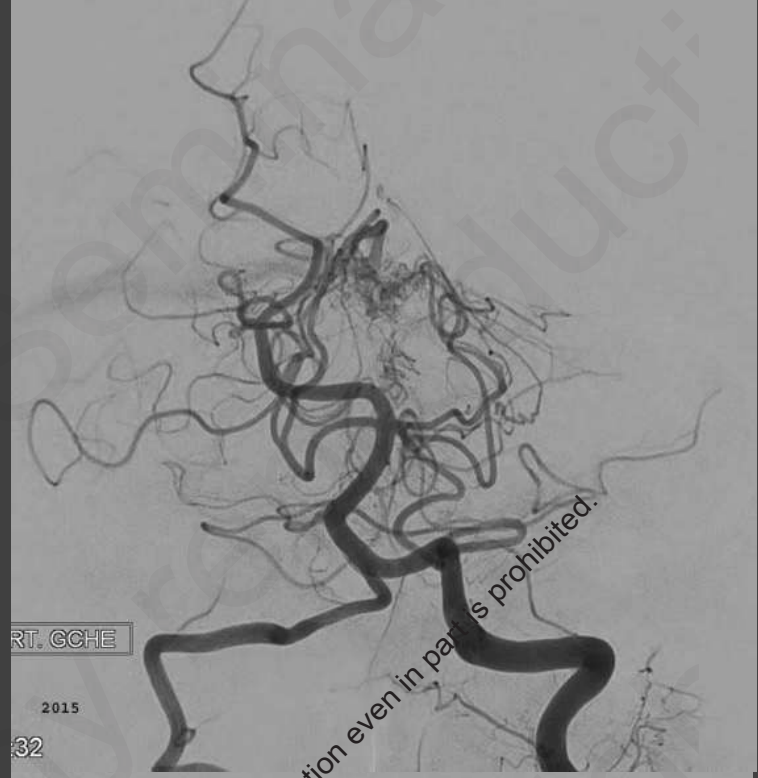


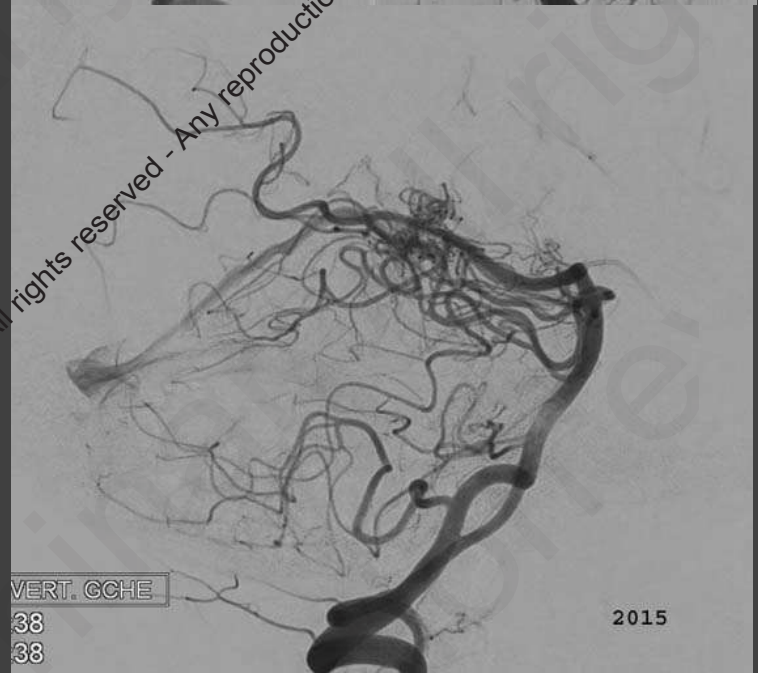


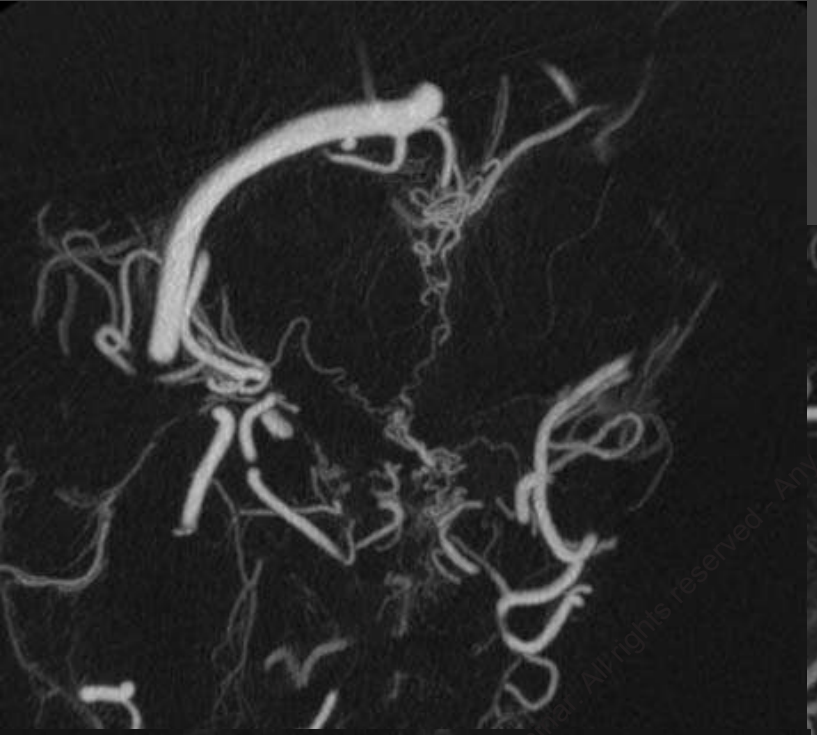


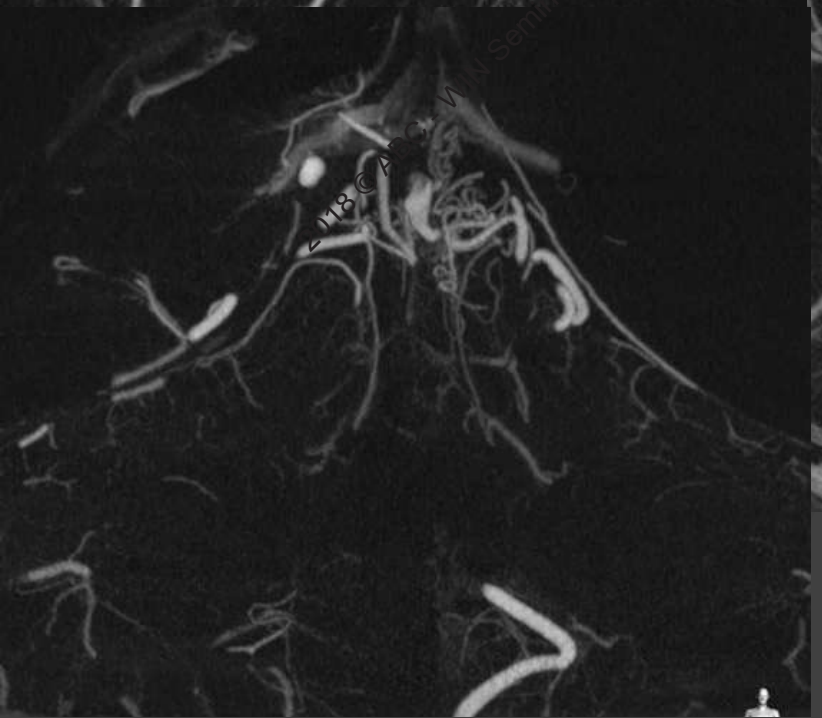


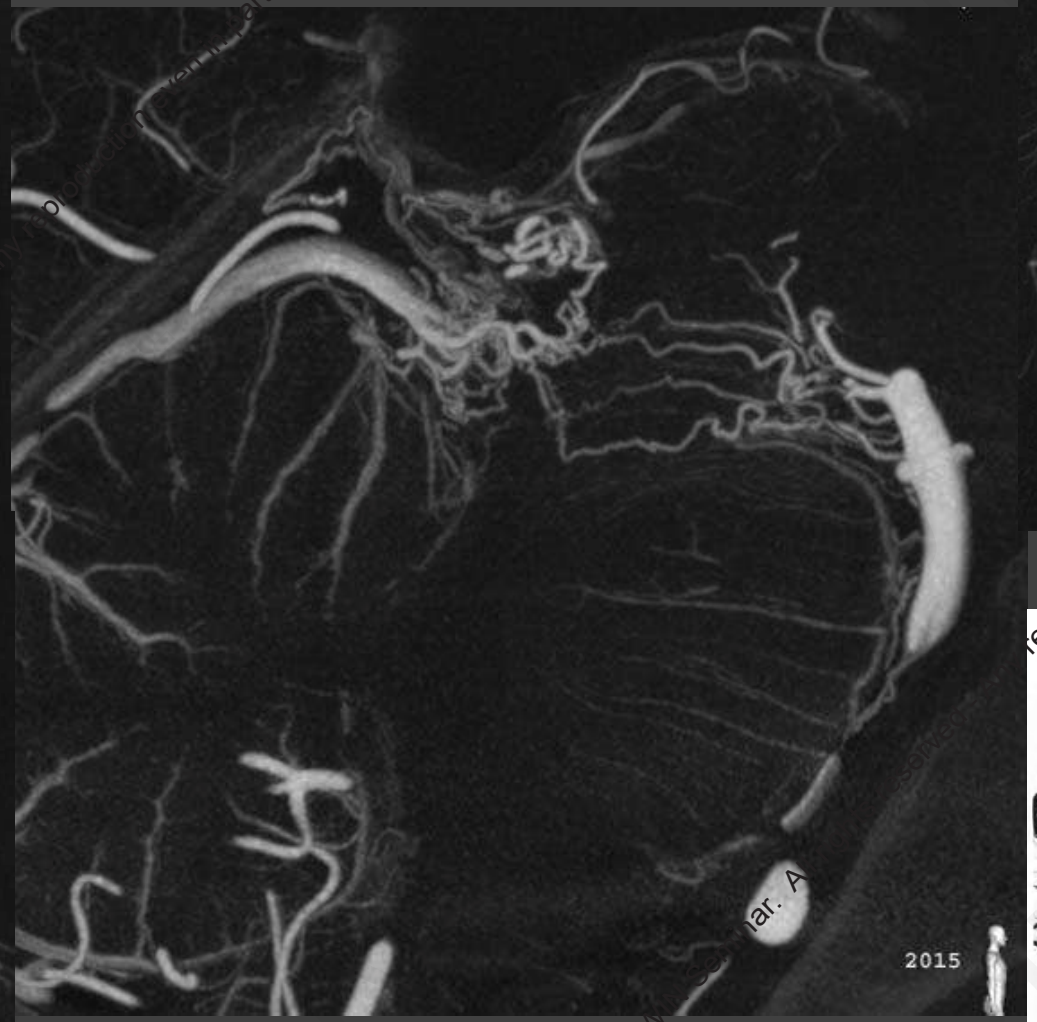
Decision for radiosurgery
(performed 2013)

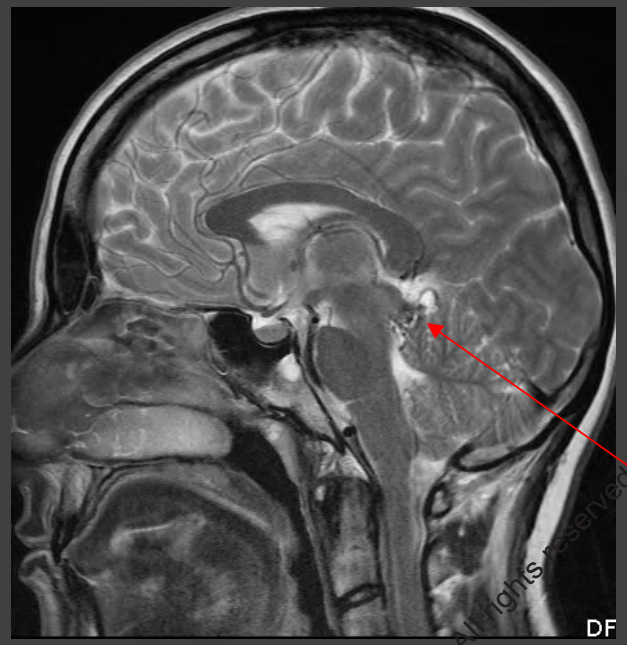


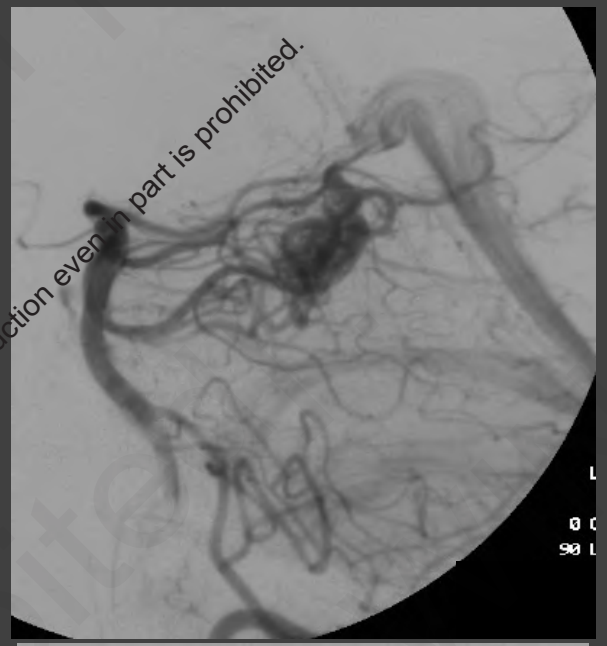




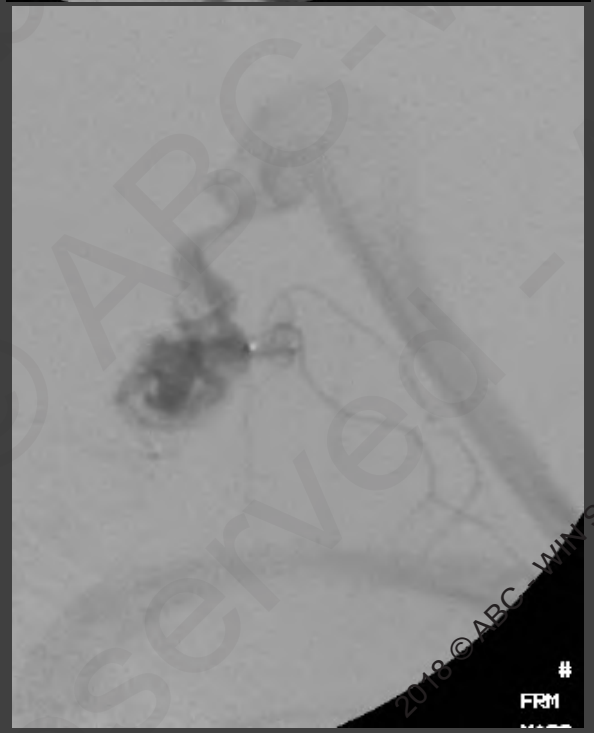


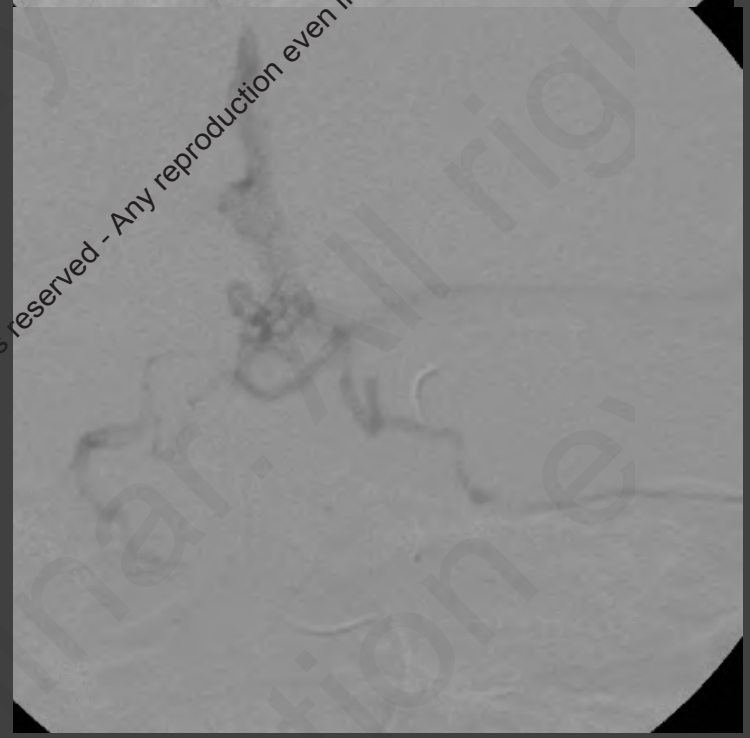


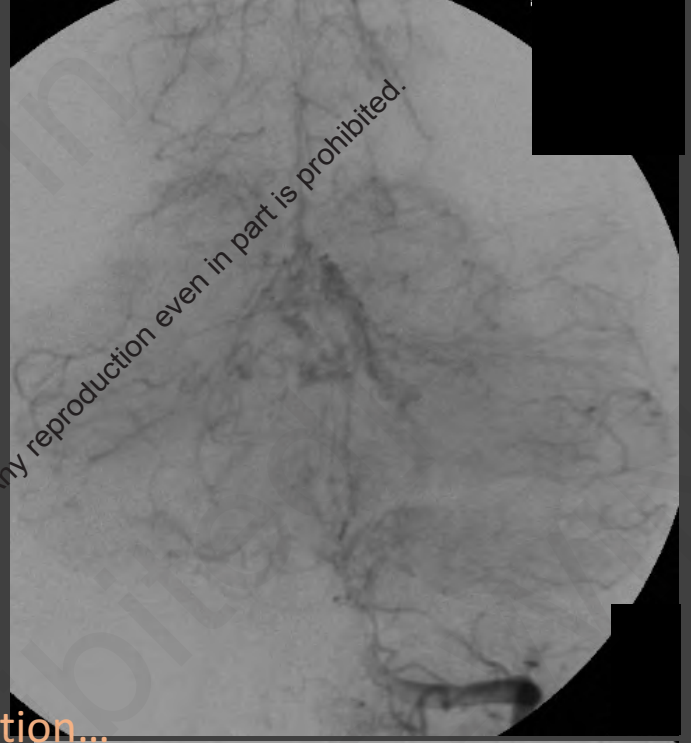




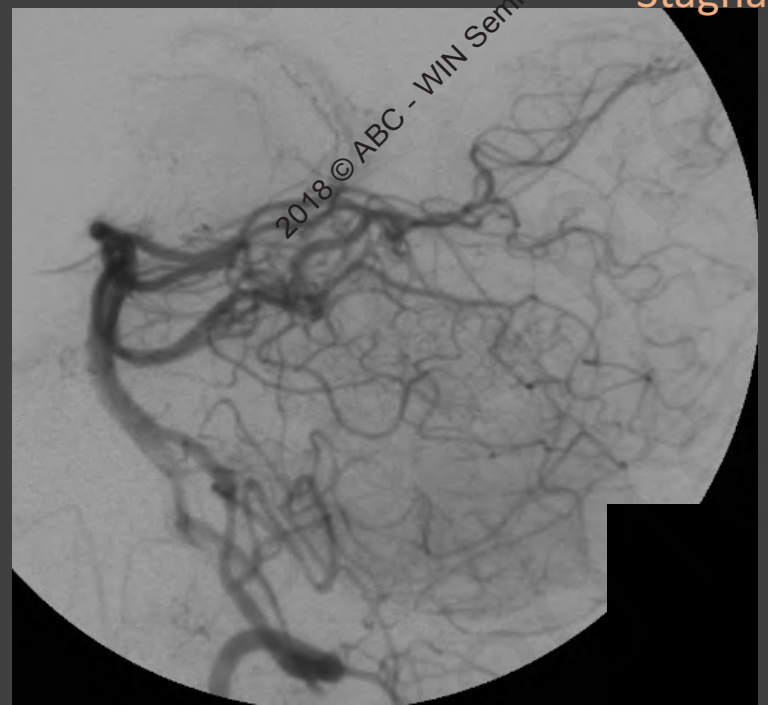
F born
1967

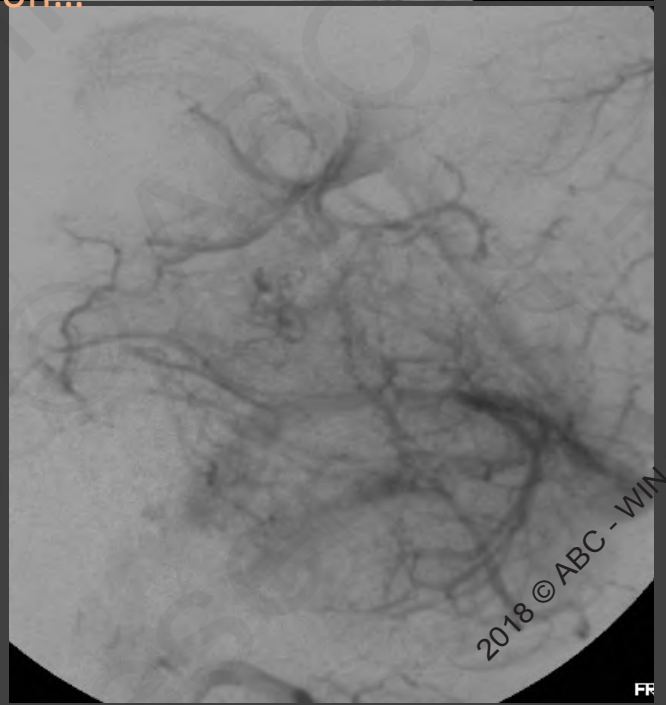


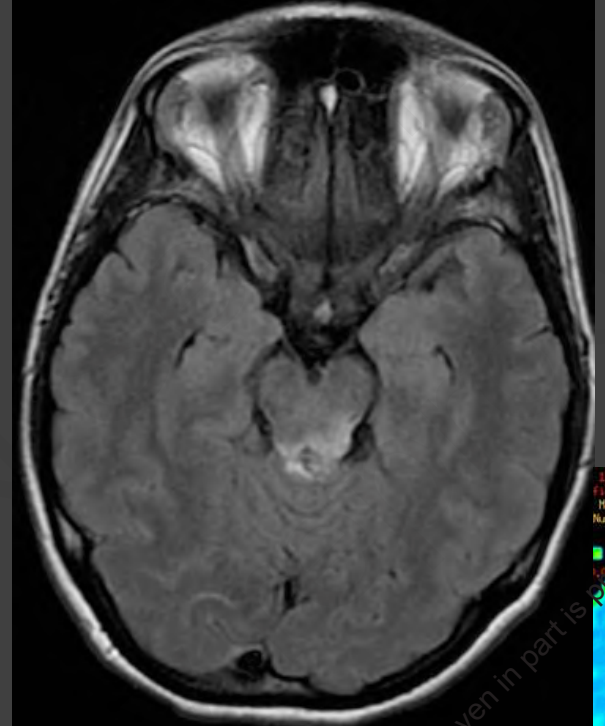


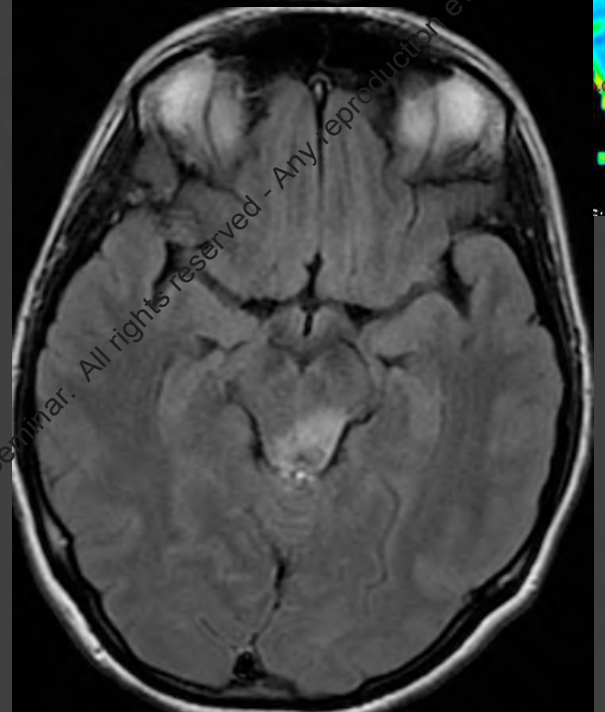


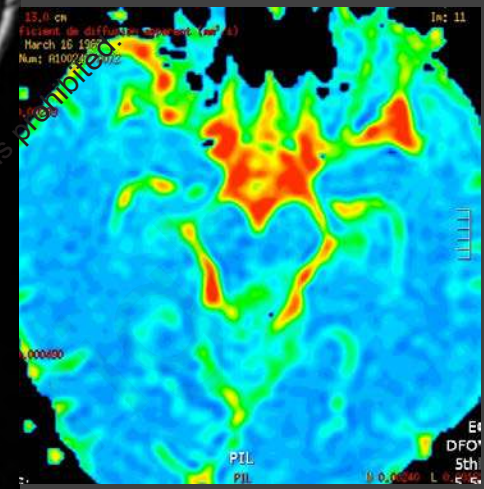
Stagnation…



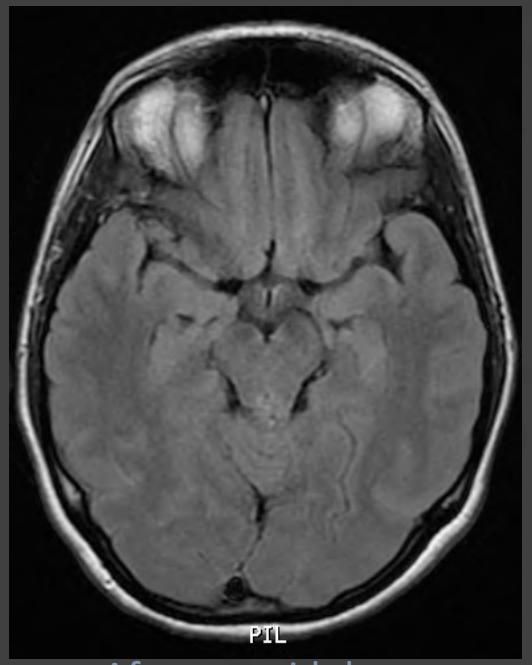






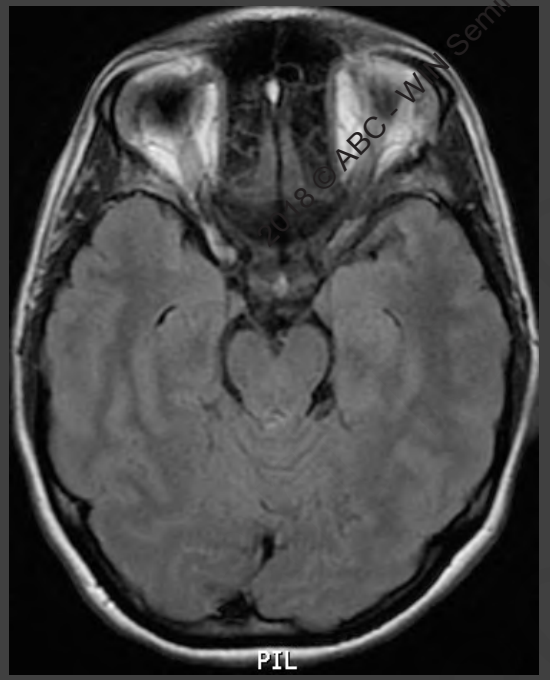


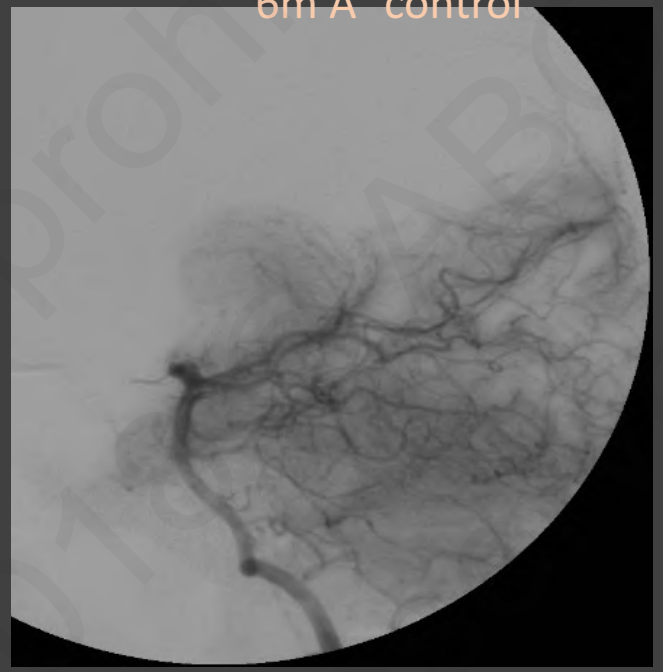
ADC map
Vasogenic edema



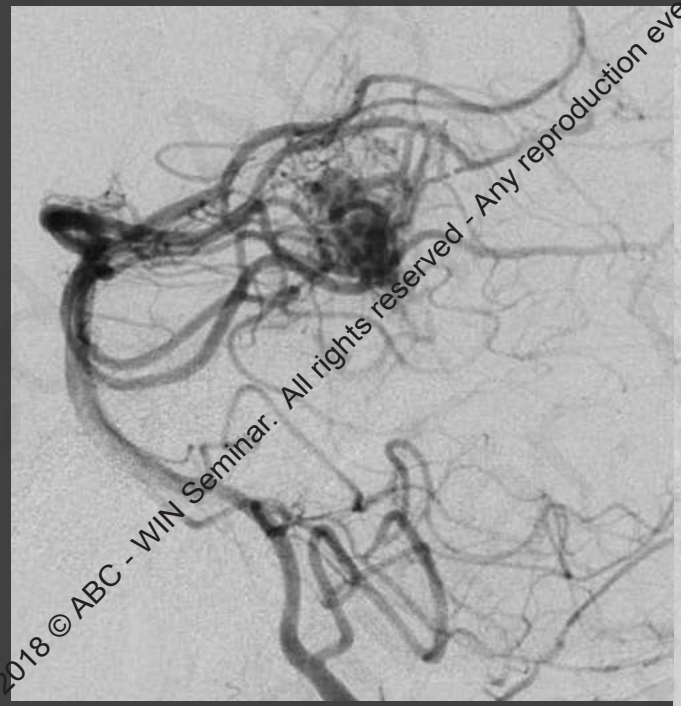
After steroid therapy

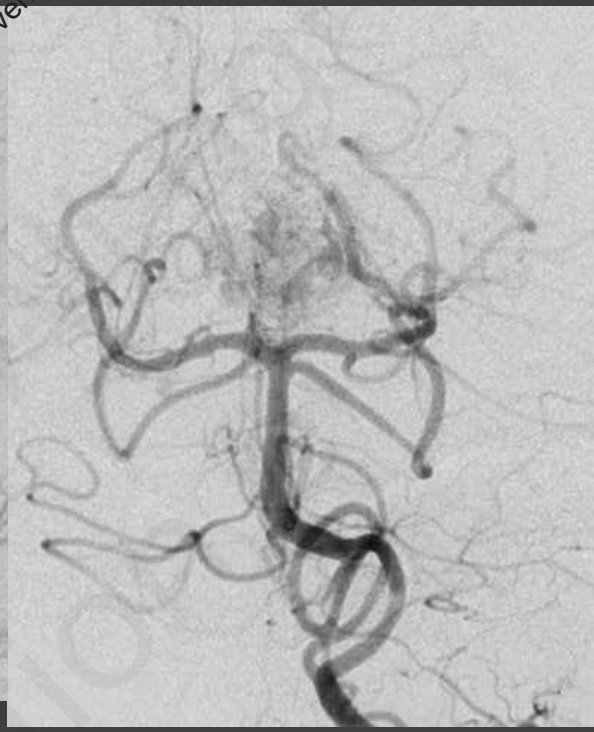
6m A° control



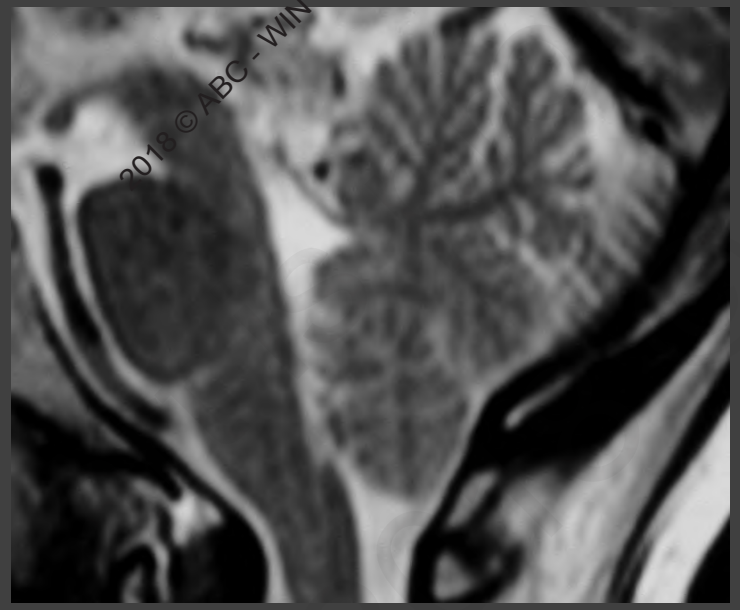


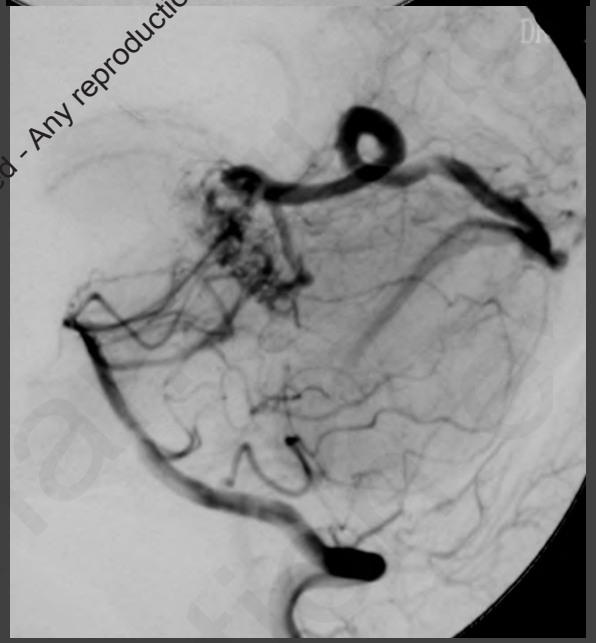
Rebleed 10 y later on the same site from a recurrent AVM….

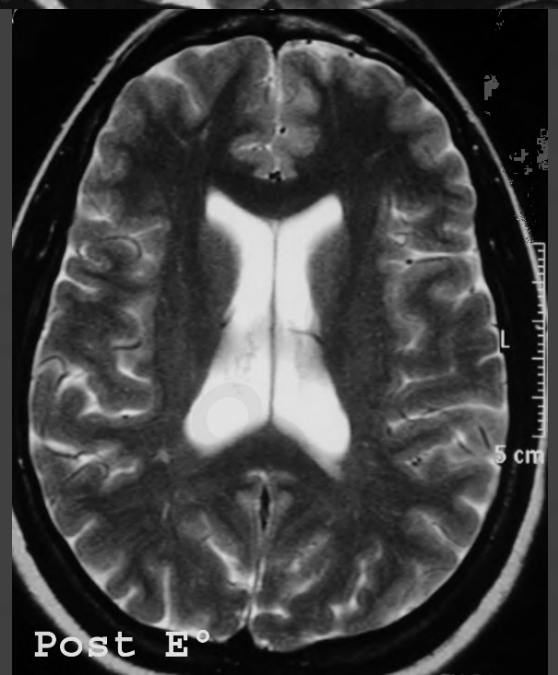




F 21 y headaches, intermittent strabismus, sensations of loss of equilibrium







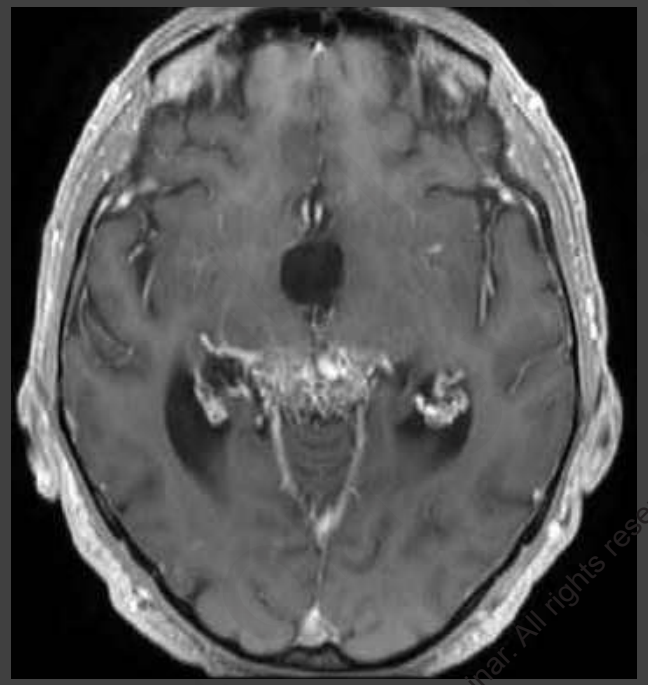
Symptoms : venous congestion of quadrigeminal plaque and mesencephalic structures involved in oculomotricity

Venous congestion of the posterior fossa

→ tonsilar prolapse

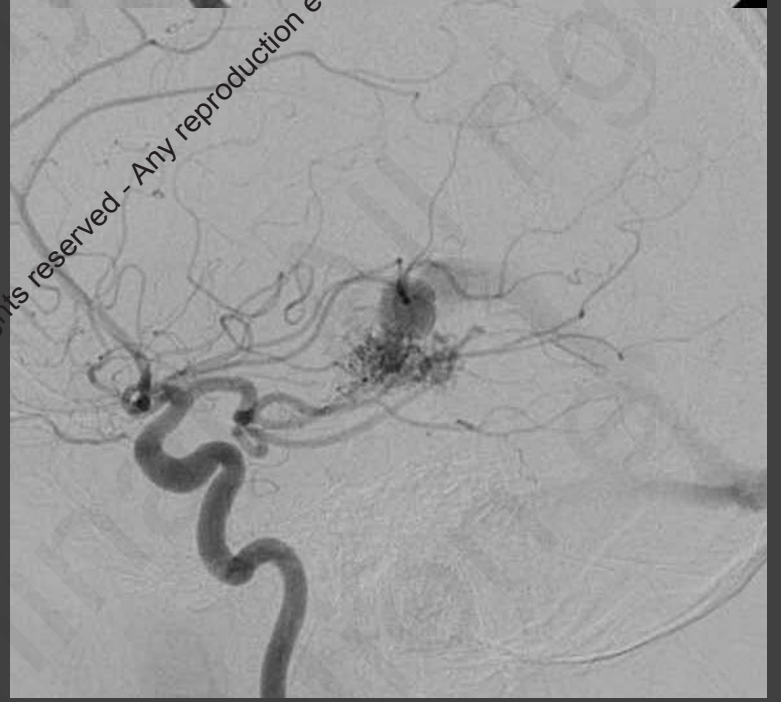
Girard N et al
Reversible tonsilar prolapse in VGAMs: report of 8 cases and pathophysiological hypothesis.
Childs Nerv Syst 10: 141-147, 1994

→ hydromyelia



M born in 1956
Operated for strabism in 1972

Followed for >20 y. No hemorrhage
Therapeutic Abstention (subpial!)
Diplopia



Conclusions

Tectal/posterior midbrain/quadrigeminal AVMs — small size

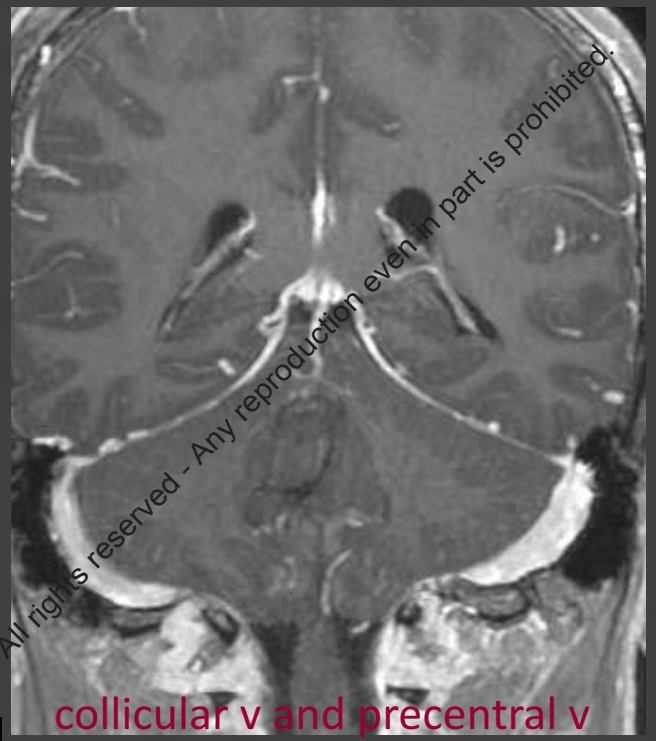
Epipial vs Subpial

Hemorrhagic presentation

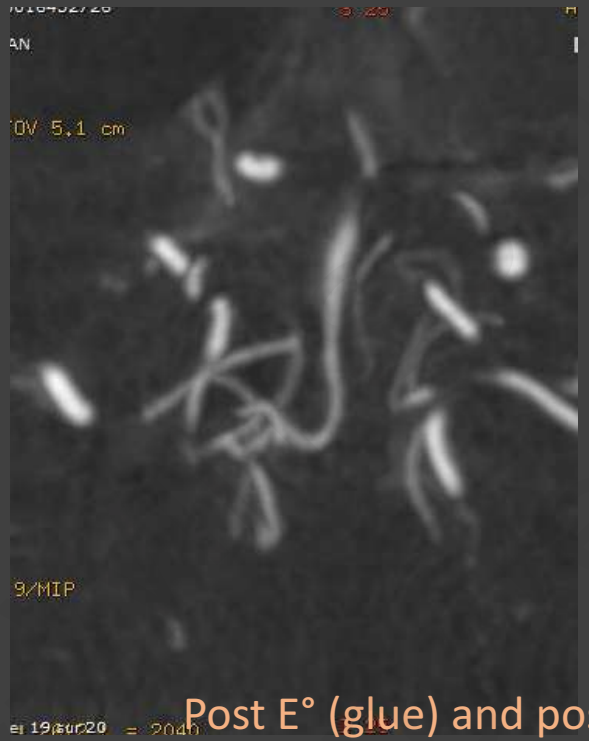
Simple architecture — rare associated AA
single (main) draining vein

Challenging lesions: Surgical treatment — Cure if epipial… but risks morbi-mortality (specially if intraparenchyma)
Embolization — Few cures
Danger of Onyx (contraindication?: reflux; penetration; toxicity DMSO)
Glue ok but needs occlusion foot of vein
(challenging and risky because of vascular network)
Angiogenesis
Transvenous approach??

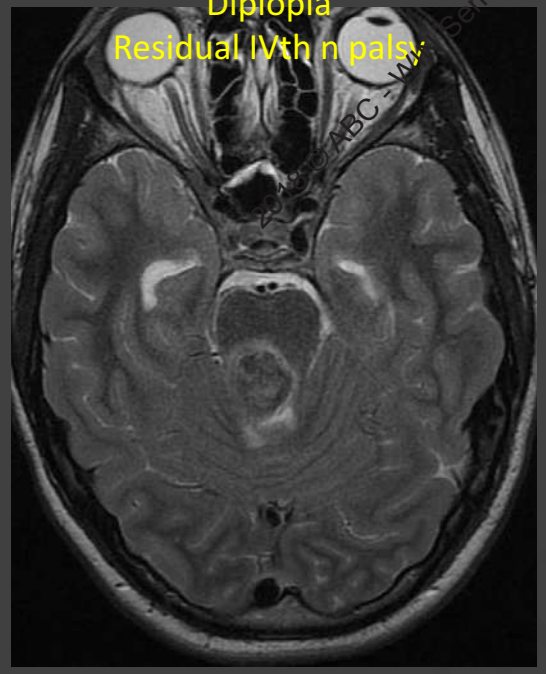
M 15y
Diplopia
Residual IVth n palsy

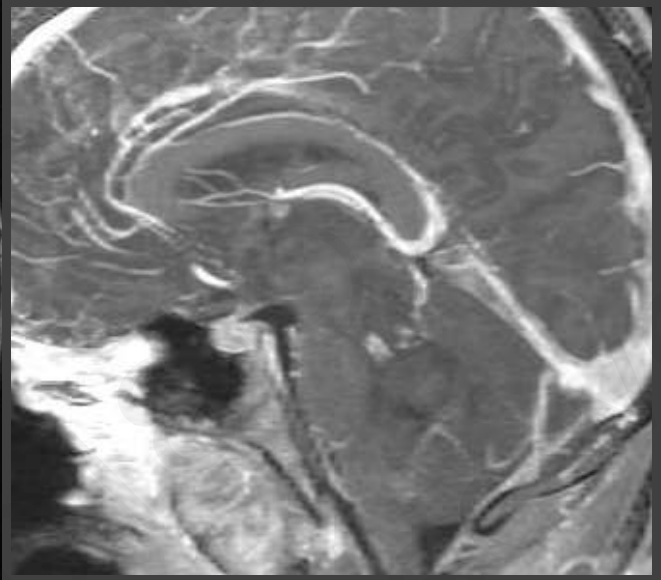


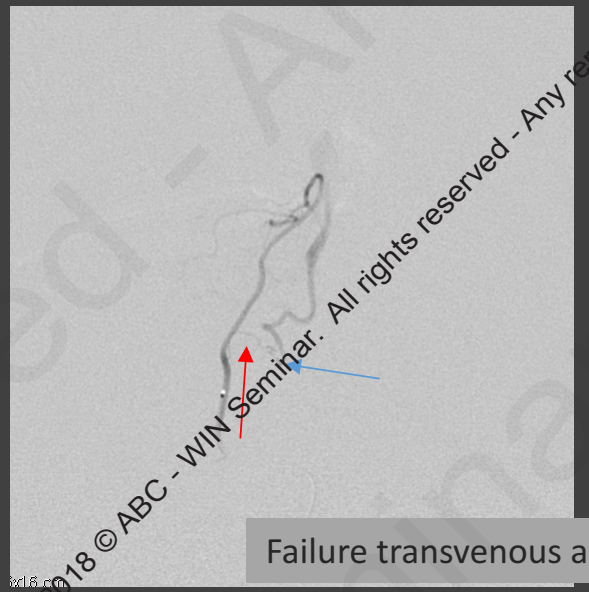
collicular v and precentral v



Post E° (glue) and post radiosurg (no result)







Failure transvenous approach. Surgery?

Conclusions

Tectal/posterior midbrain/quadrigeminal AVMs small size

Epipial vs Subpial

Hemorrhagic presentation

Simple architecture rare/ exceptional associated AA (specific biology of tectal plate?)
one (two…) draining veins

Challenging lesions: Surgical treatment Cure if epipial… but risks morbi-mortality (specially if intraparenchyma)
Embolization Few cures
Danger of Onyx (contraindication?: reflux; penetration; toxicity DMSO)
Glue ok but needs occlusion foot of vein
(challenging and risky because of vascular network)
Angiogenesis
Transvenous approach??
Radiosurgery Risk of rebleeding in the latency period. Higher risks for tectal AVMs

Combination and association of treatments. Selection of patients. Need for long FUs