

ANTERIOR SKULL BASE DURAL FISTULAS

DANIEL ROY

CANADA



JANUARY 13-18, 2019

2019 © ABC - WIN Seminar. All rights reserved. Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved. Any reproduction even in part is prohibited.

PLAN

- Anatomy (enigma?)
- Classification
- Venous patterns
- Clinical presentation
- Management strategies
 - Surgery
 - Endovascular

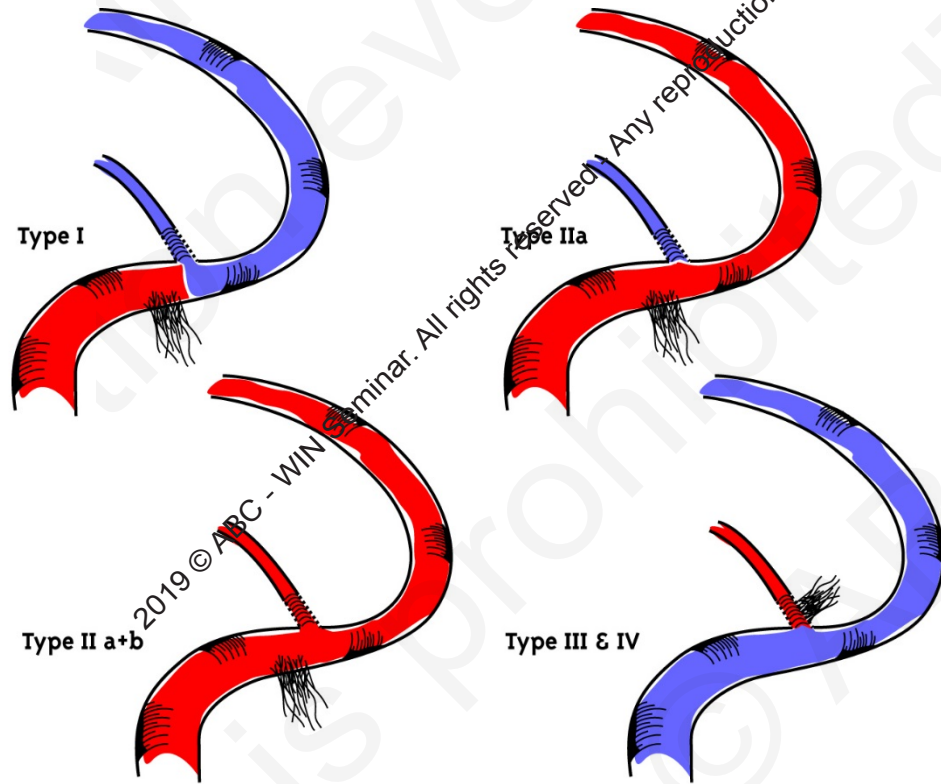


2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

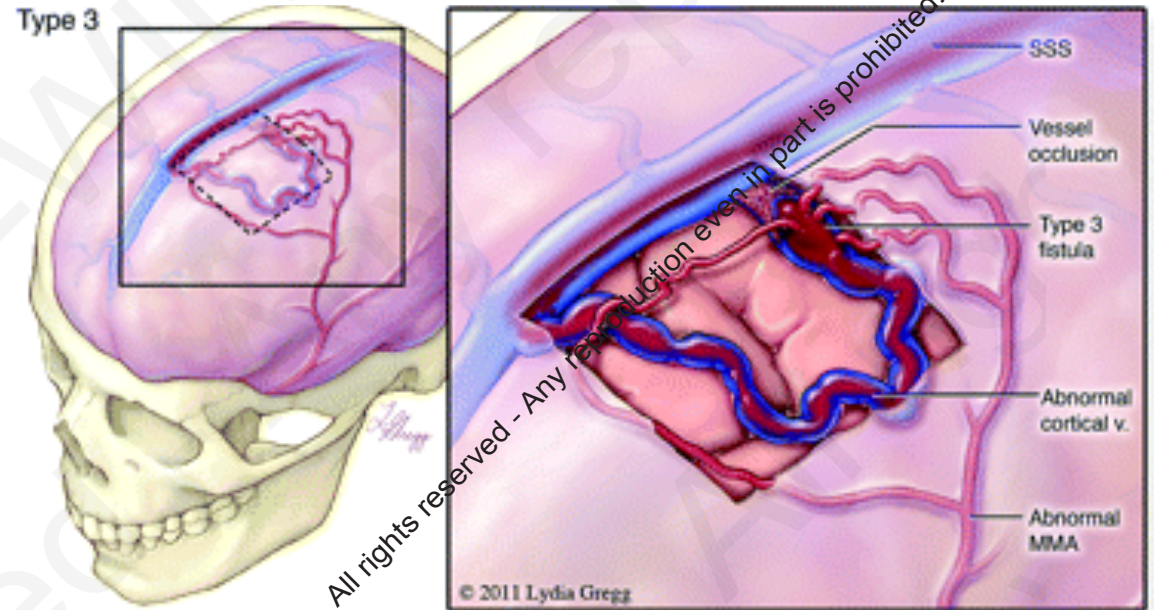
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

The anatomical « enigma » of ethmoidal DAVFs

Intracranial Dural Arteriovenous Fistulas:
Classification, Imaging Findings, and Treatment
AJNR Am J Neuroradiol 33:1007–13 Jun-Jul 2012



Relation of veins and dura

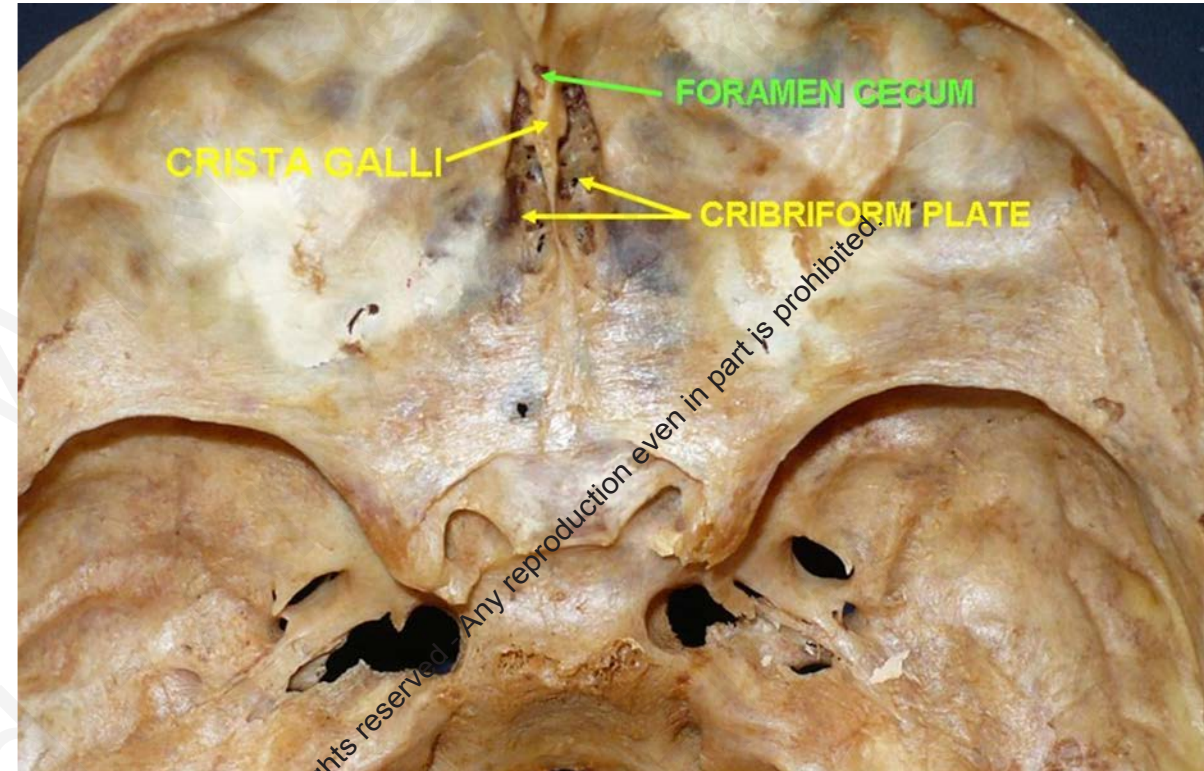


For ethmoidal DAVFs, there is no nearby collecting sinus

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Foramen caecum

- Located anterior to the Crista Galli
- Communication between nasal cavity and anterior fossa
- May be the route of infection spreading
- Controversy among anatomists¹⁻³ on its patency and the existence of true vein bridging from the nasal mucosa to the superior sagittal sinus
- Maybe present in early childhood⁴⁻⁶ with later regression



1. Zuckerkandl E. **Ueber den Circulations-Apparat in der Nasenschleimhaut.** *Denkschriften der kaiserlichen Akademie der Wissenschaften in Wien. Mathematisch-naturwissenschaftliche Classe* XLIX 1885:131–52
2. Thewissen JGM. **Mammalian frontal diploic vein and the human foramen caecum.** *Anat Rec* 1989;223:242–44
3. Kaplan HA, Browder A, Browder J. **Nasal venous drainage and the foramen caecu.** *Laryngoscope* 1973;83:327–29
4. Theile FW. *Vom Baue des menschlichen Körpers.* Bd III. Leipzig;1847
5. Luschka A. *Anatomie des menschen.* NN, Tu"bingen;1867
6. Hédon CE. **Étude anatomique sur la circulation veineuse de l'encéphale.** Thèse de la Faculté de Médecine de Bordeaux. 1888:1–96

CASE REPORT

D. San Millán Ruíz
P. Gailloud
D.A. Rüfenacht
H. Yilmaz
J.H.D. Fasel

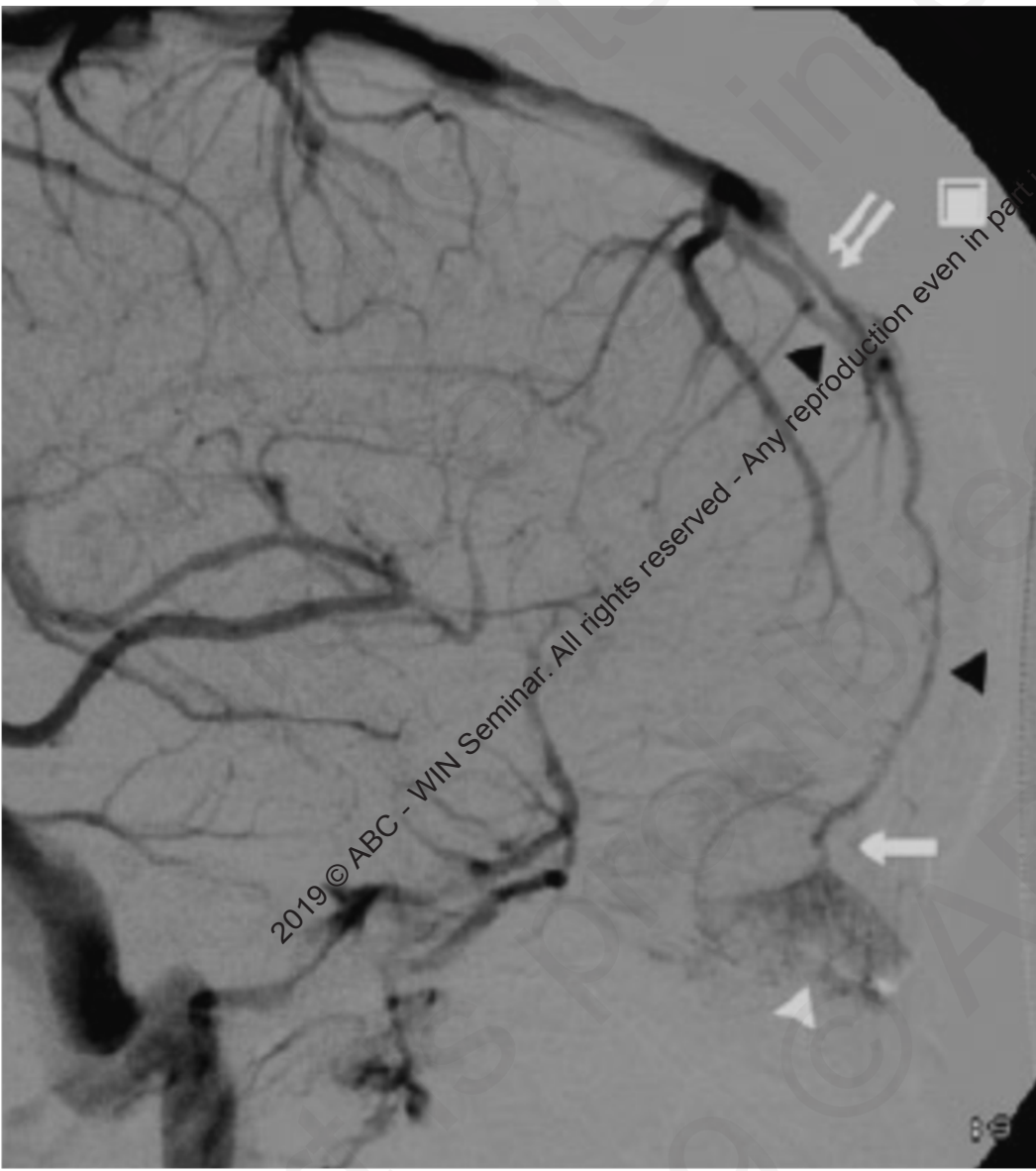
Anomalous Intracranial Drainage of the Nasal Mucosa: A Vein of the Foramen Caecum?

SUMMARY The existence of the vein of the foramen caecum (VFC) in humans is still controversial. We present 2 patients with intracranial drainage of the nasal mucosa by a frontal cortical vein into a superior sagittal sinus, demonstrated by digital subtraction angiography. In both, the position of the intracranial passage was found to be slightly paramedian. An analogy to the VFC is made.

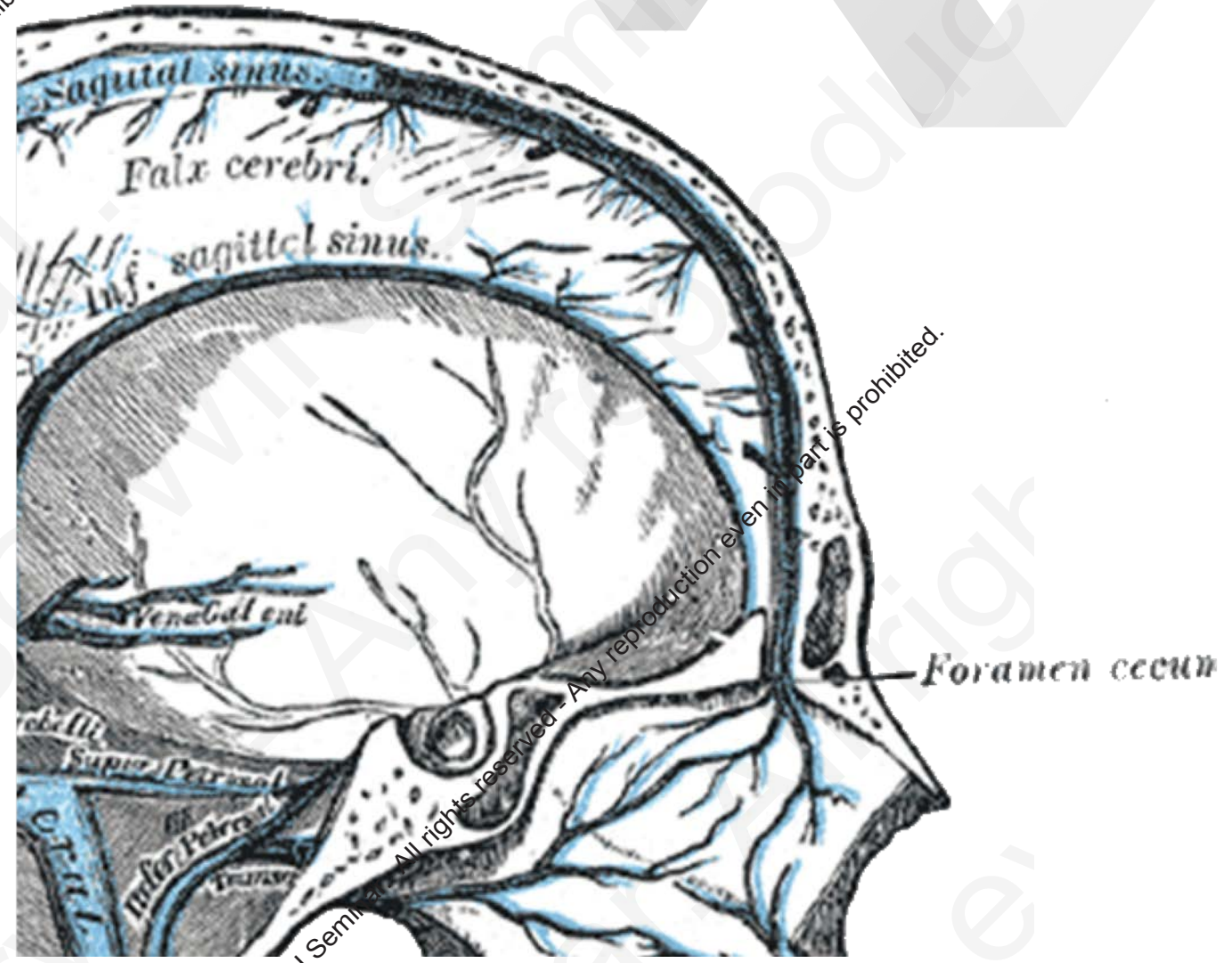
AJNR Am J Neuroradiol 27:129–31 Jan 2006

2019 © ABC - WIN Seminar. All rights reserved. Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved. Any reproduction even in part is prohibited.



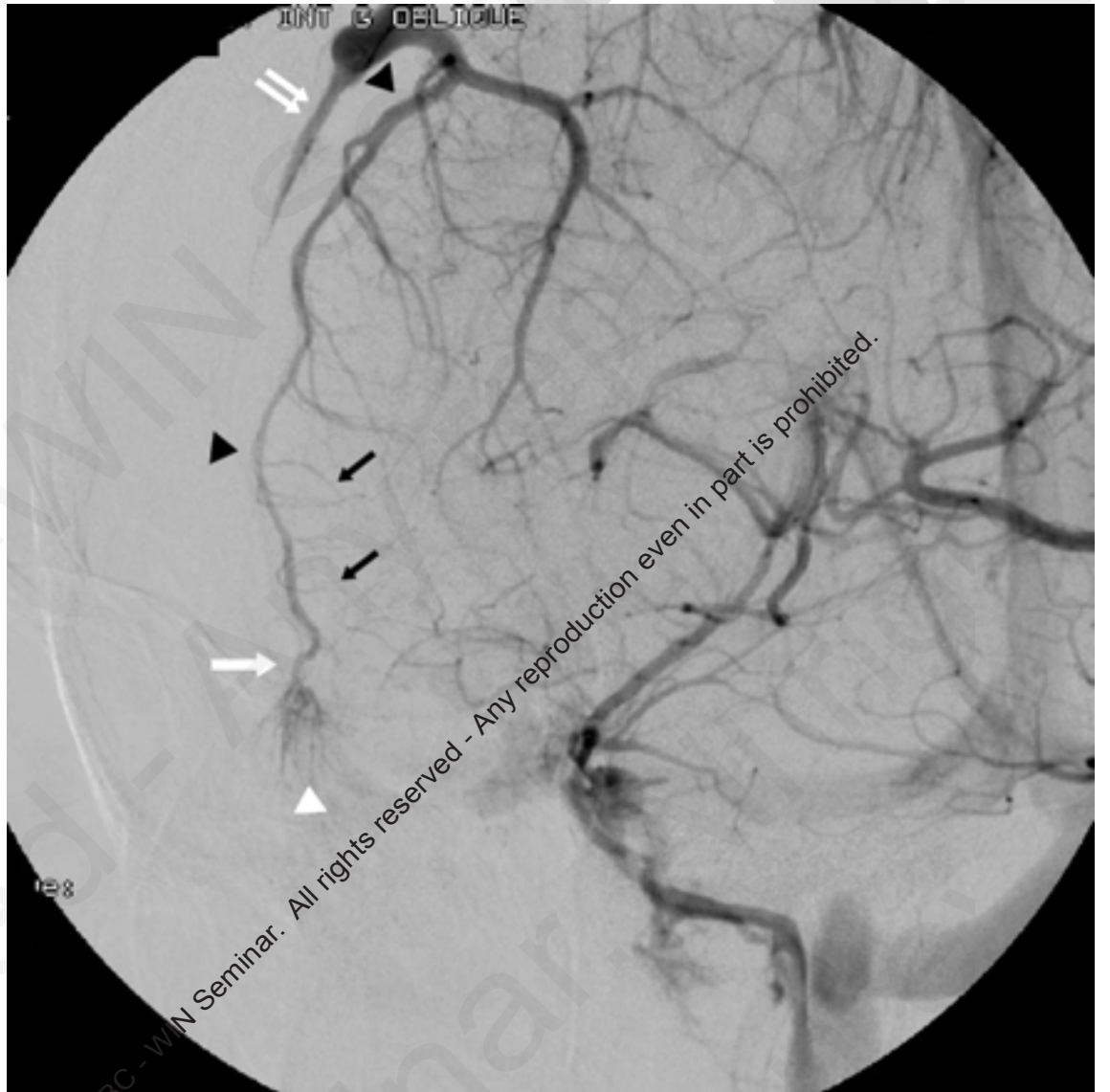
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



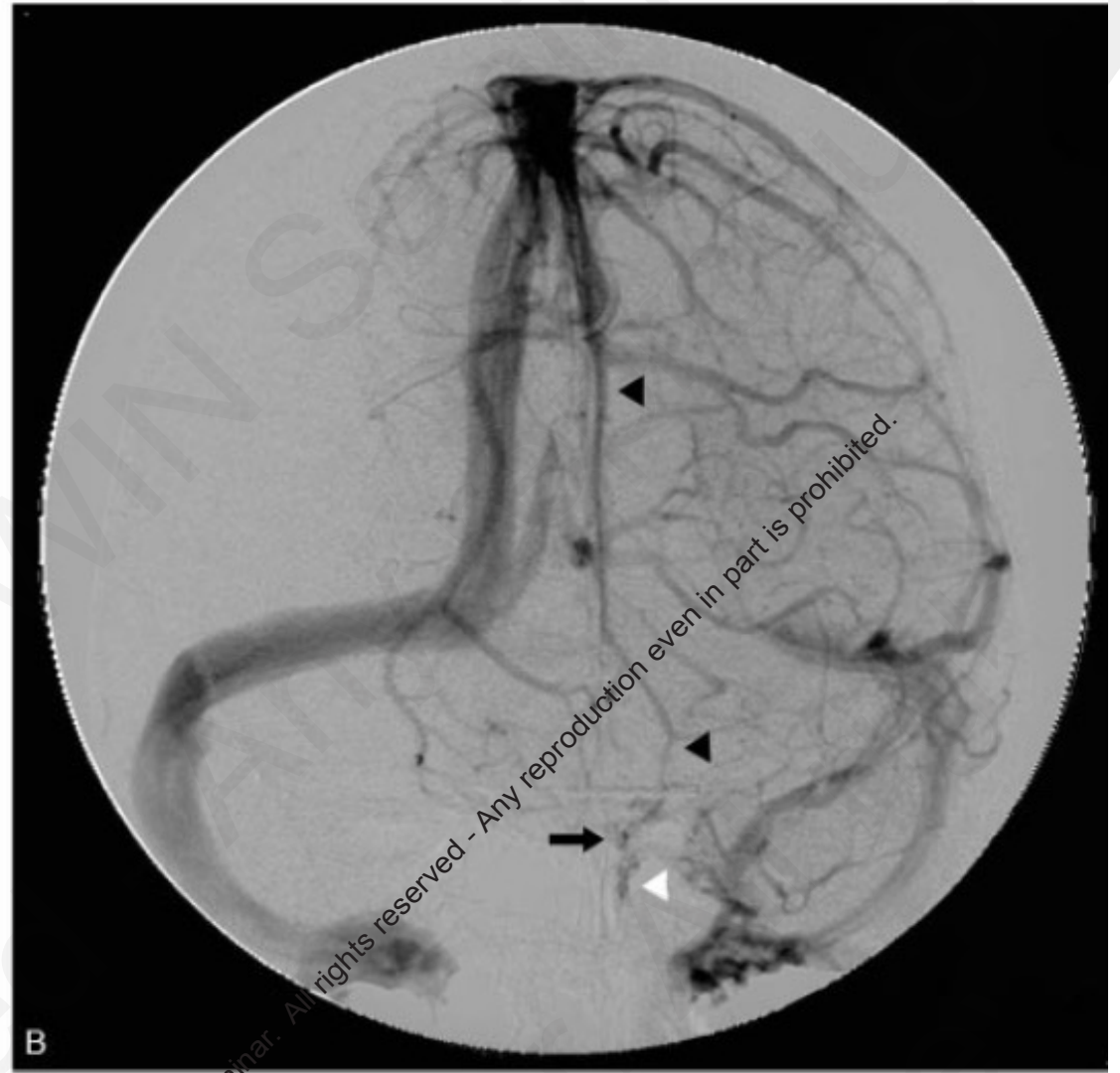
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



AJNR Am J Neuroradiol 27:129-31 Jan 2006



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



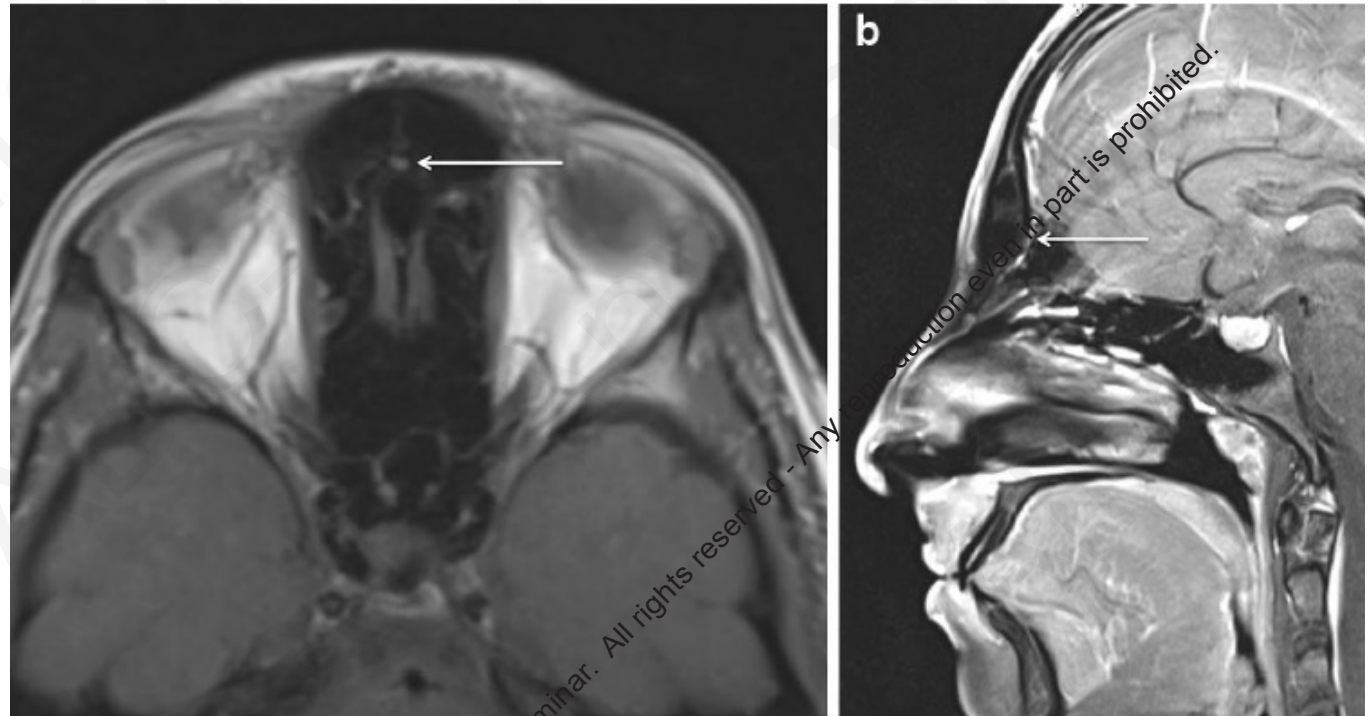
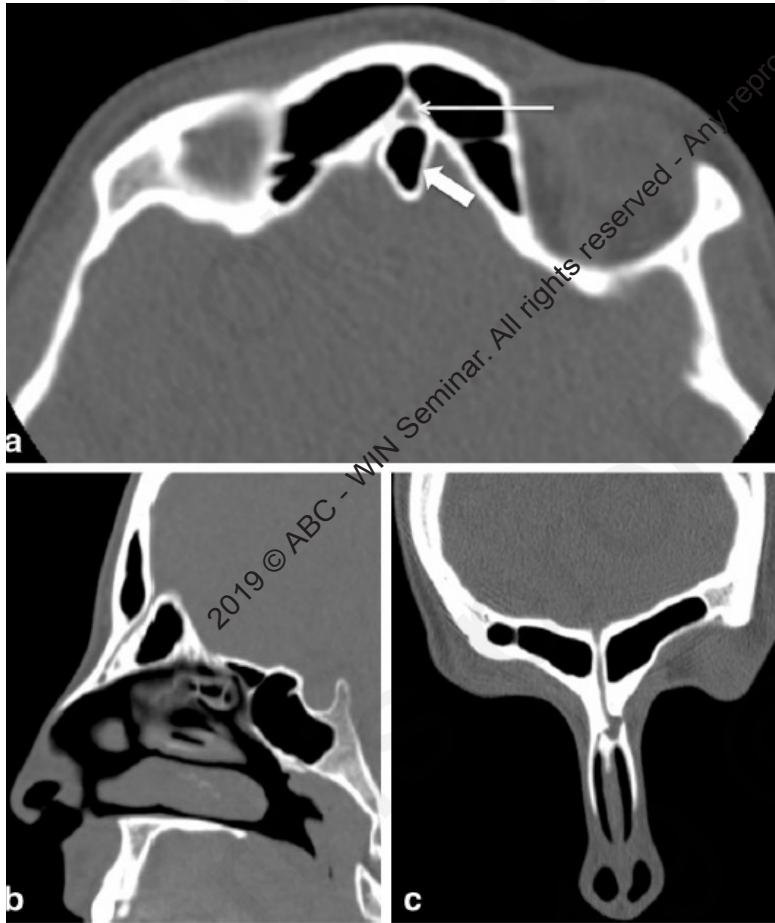
AJNR Am J Neuroradiol 27:129–31 Jan 2006

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Vein of foramen caecum: imaging findings

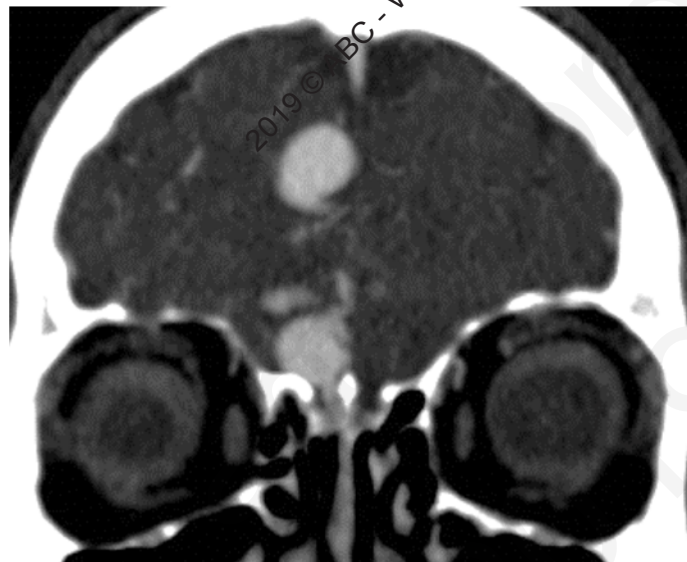
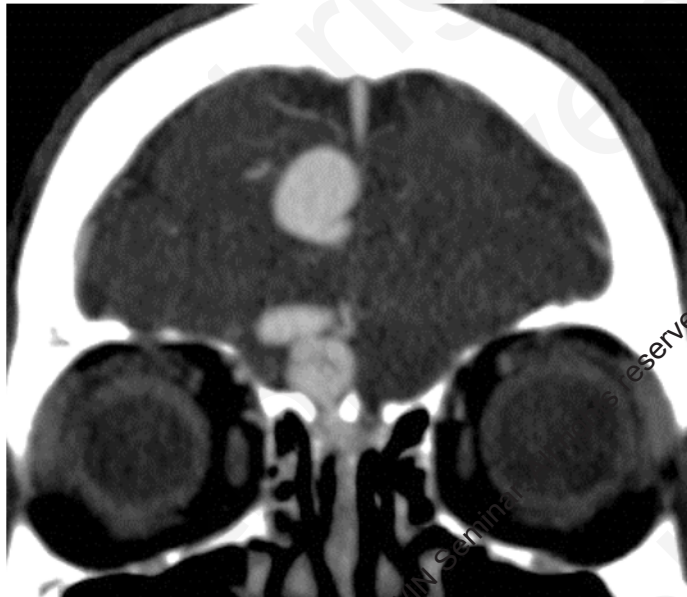
Surgical and Radiologic Anatomy, July 2016, Volume 38, Issue 5, pp 615–617

Onur Tutar, Sedat Giray Kandemirli, Duzgun Yildirim, Emine Sebnem Memis, Selim Bakan



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

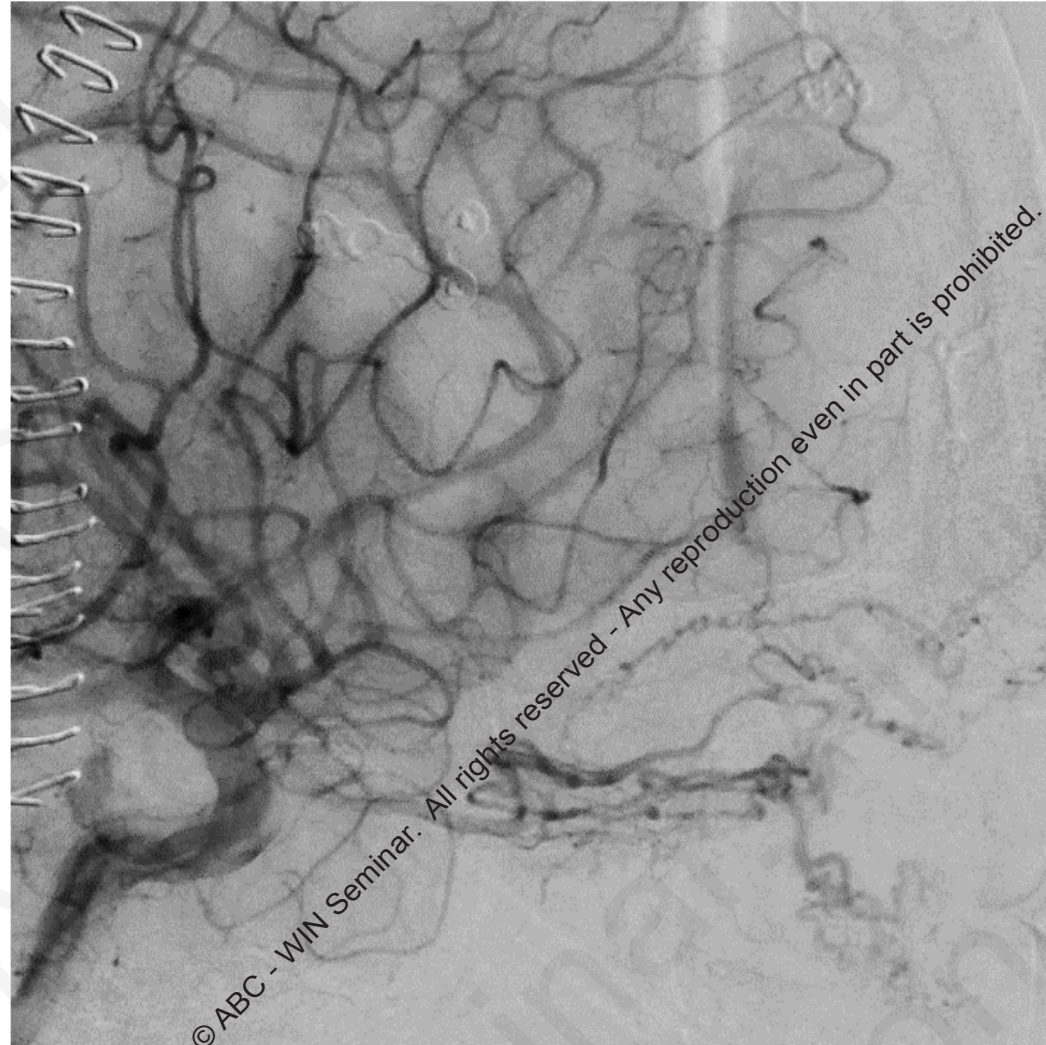
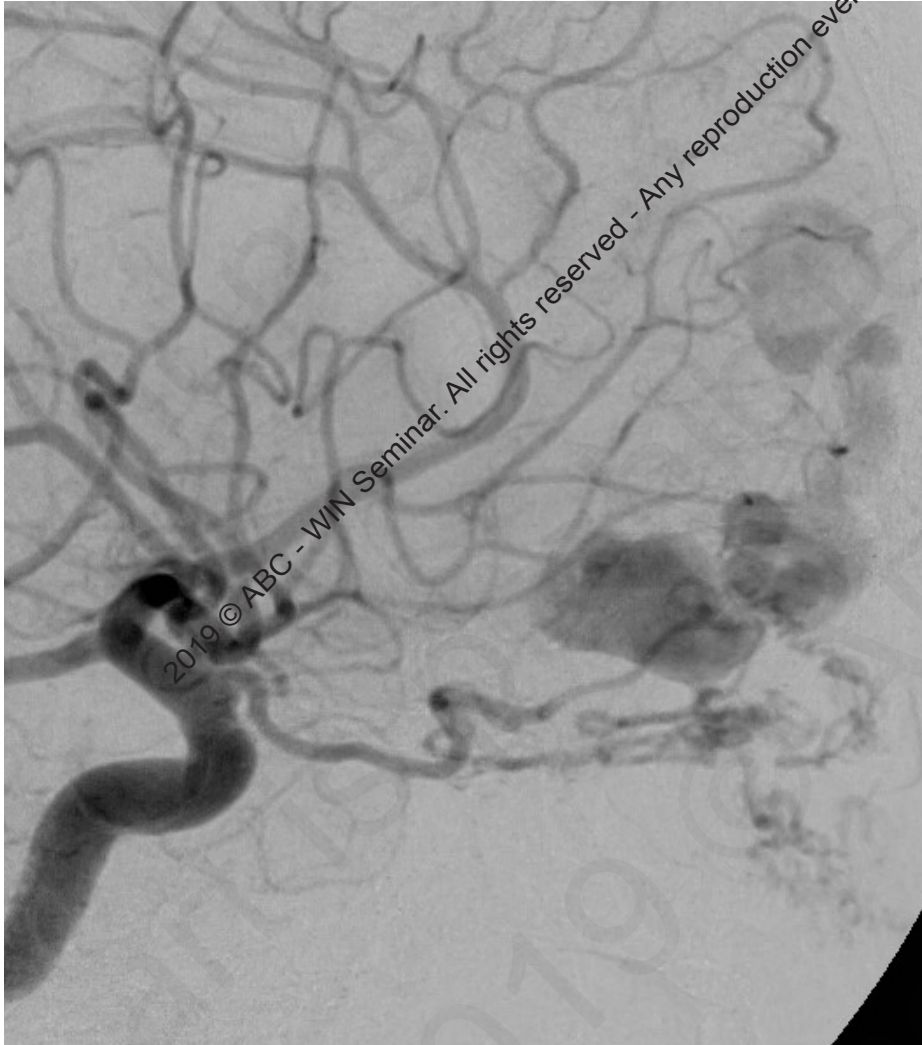
Vein of the foramen caecum and DAVF



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

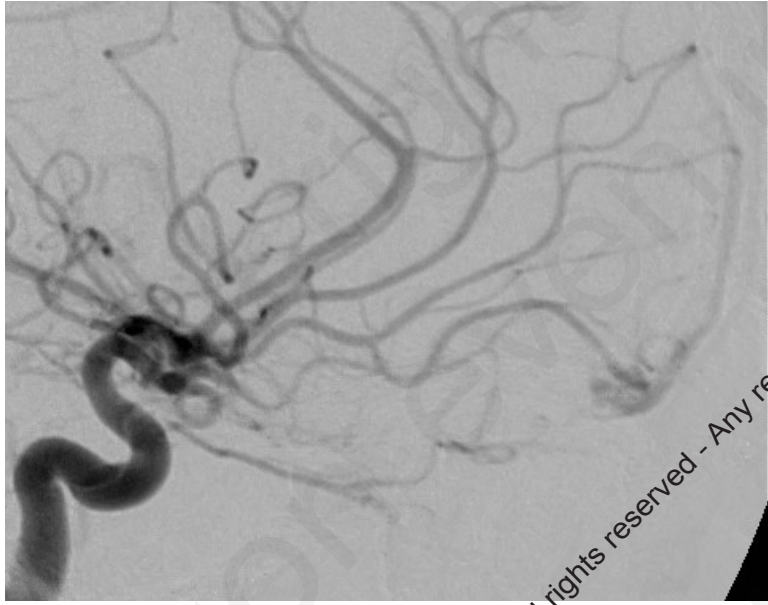
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Vein of the foramen caecum and DAVF

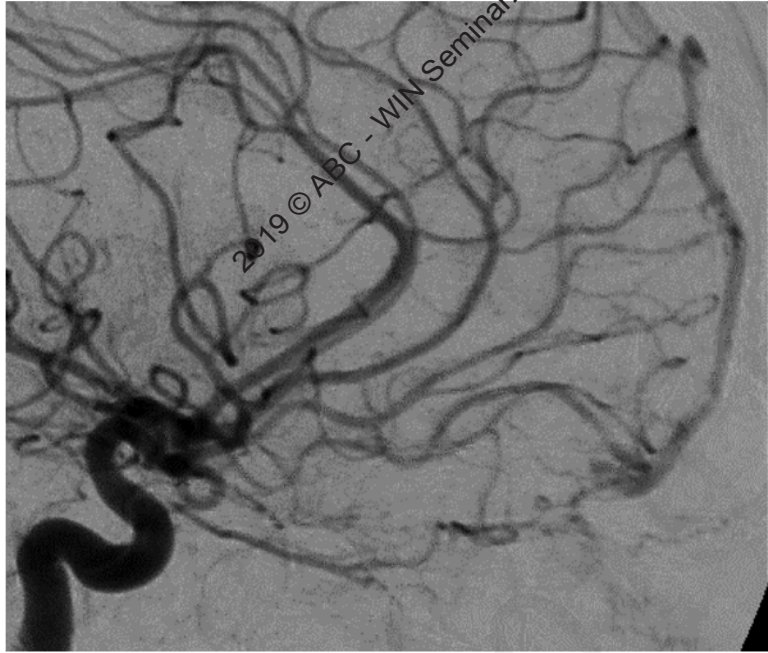


2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

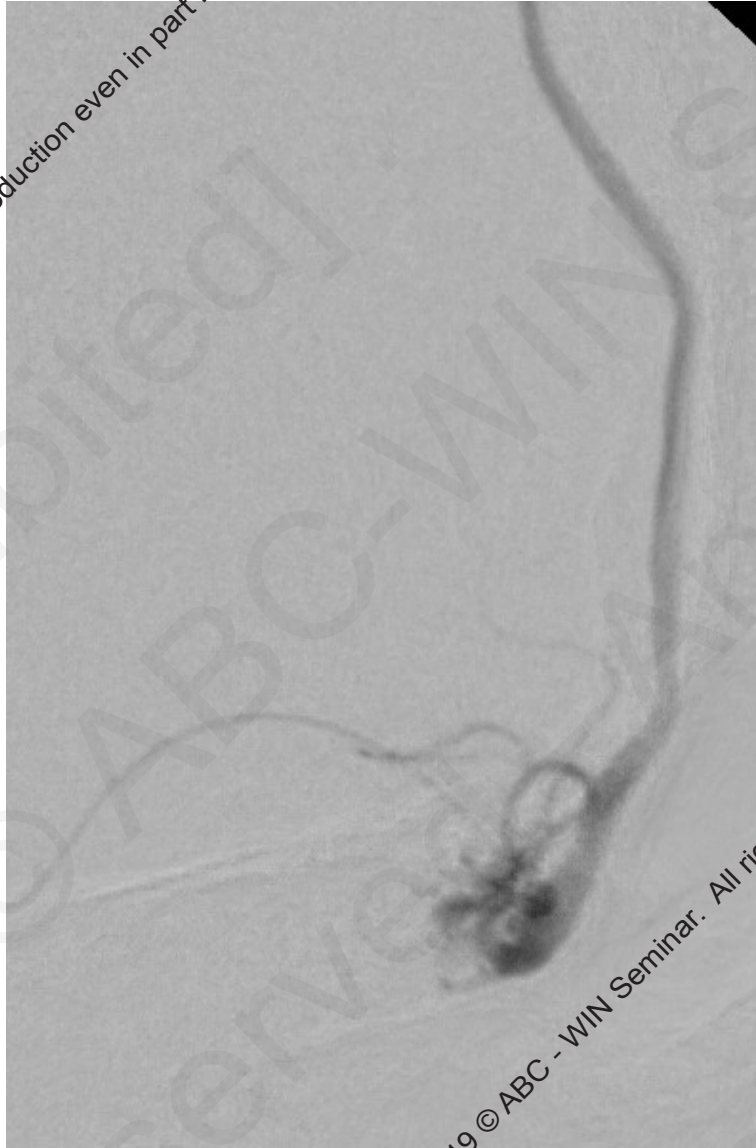
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



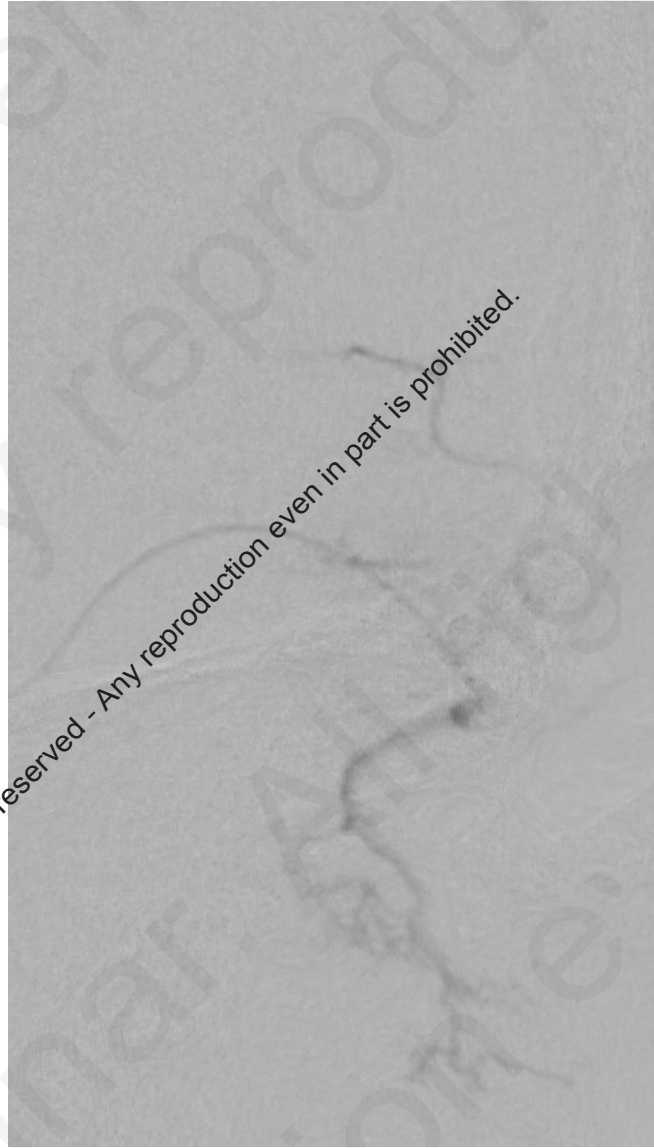
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



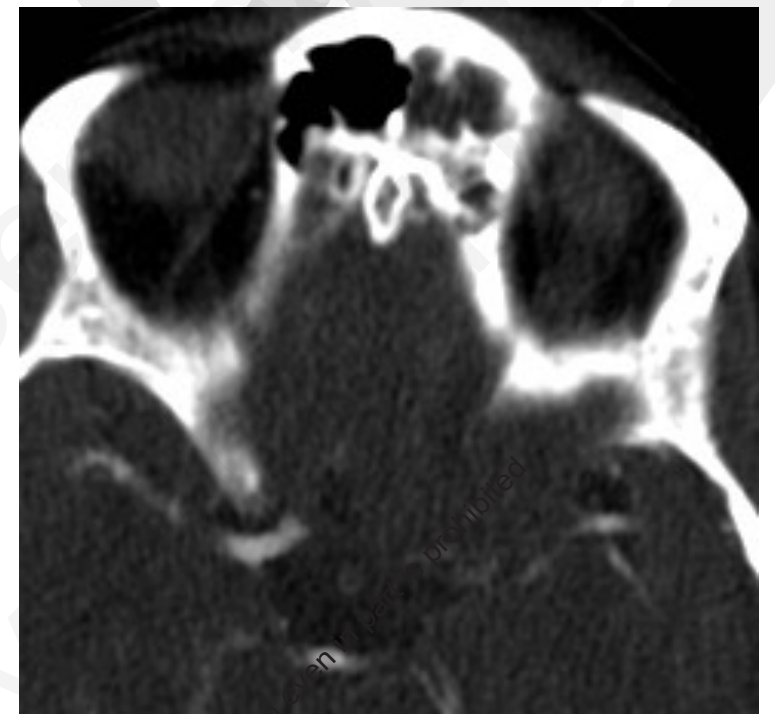
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

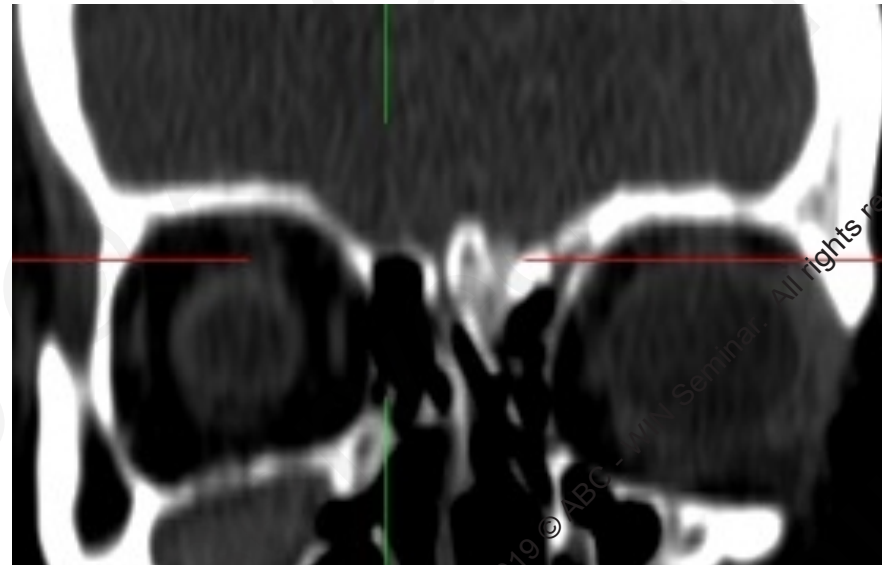


2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction or distribution is prohibited.

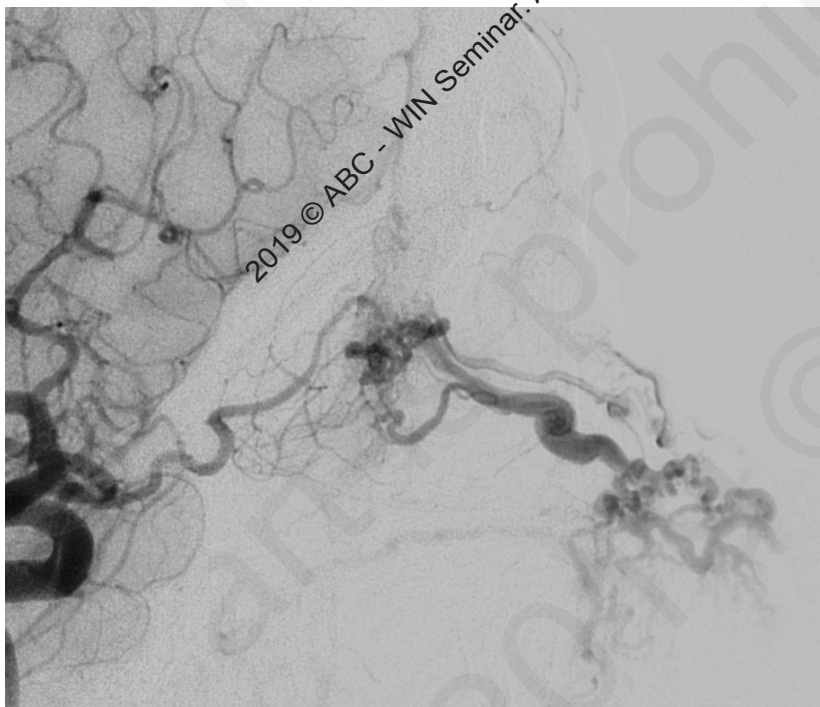
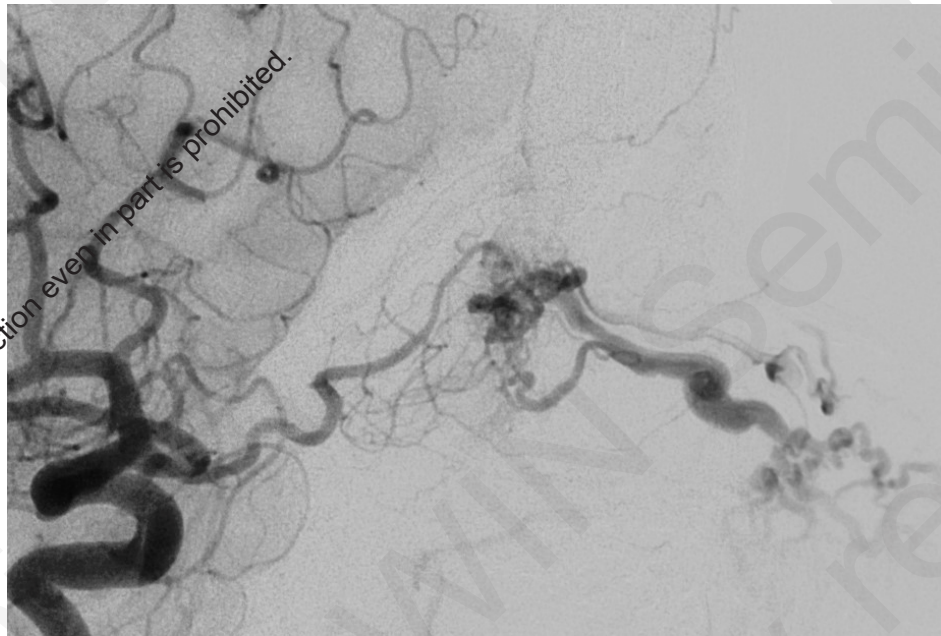
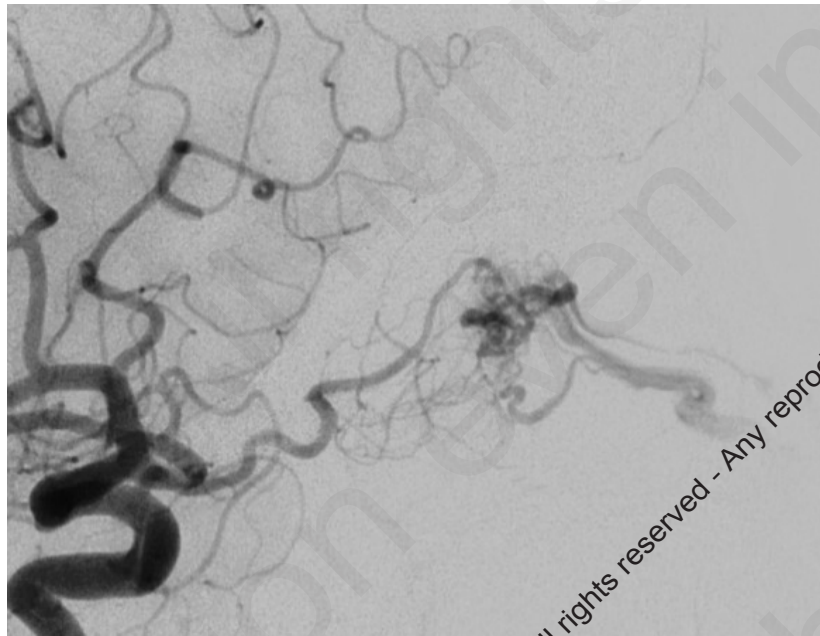
Intractable epistaxis



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction or distribution is prohibited.

The missing link?

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction or distribution is prohibited.



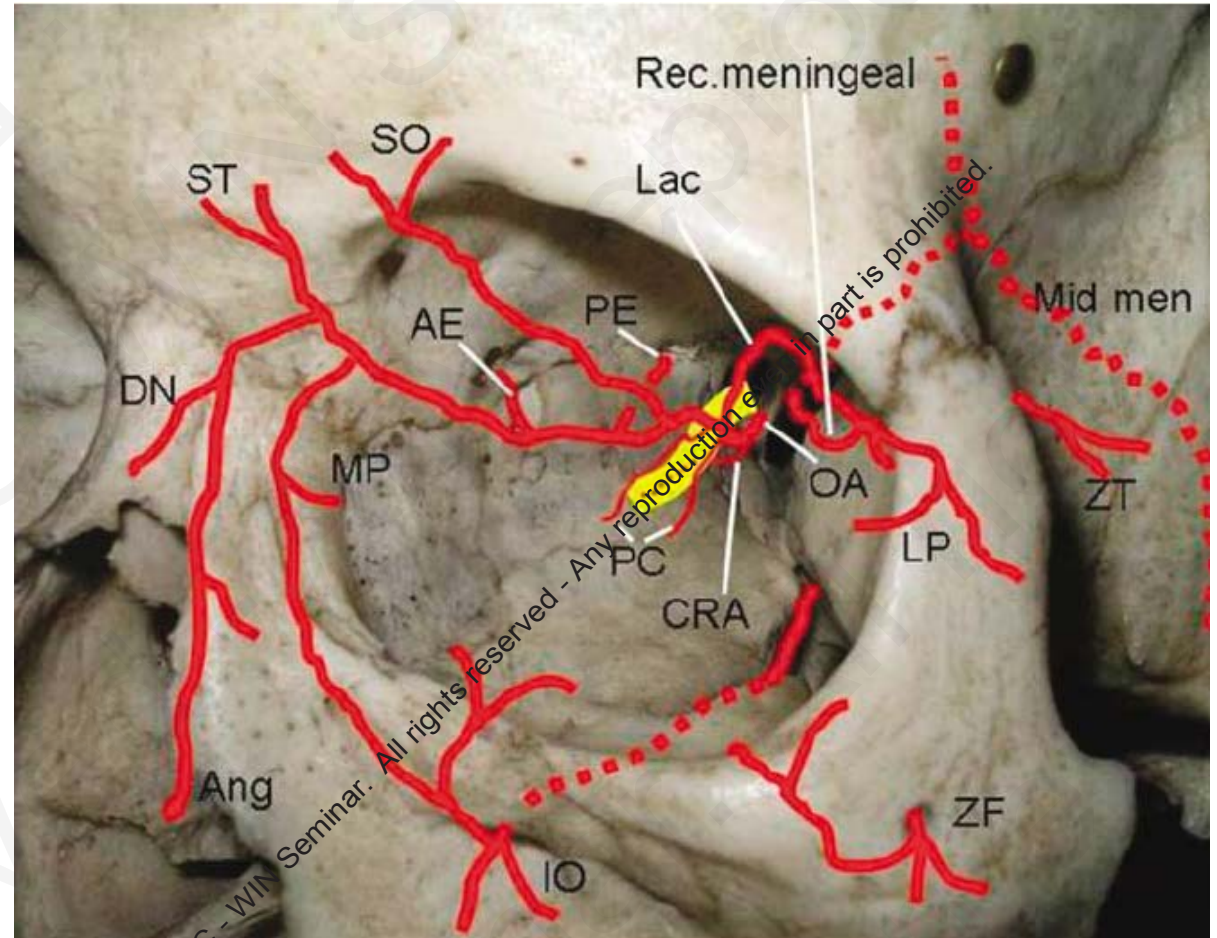
The missing link?

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Arterial supply

- Ophthalmic artery
 - Ethmoidal branches
- Internal maxillary artery
 - Anastomoses with ethmoidal branches
- Middle meningeal artery
 - Anastomoses with the OA
 - Via anterior falcine artery
- Cutaneous arteries
 - Anastomoses with the OA



Venous drainage

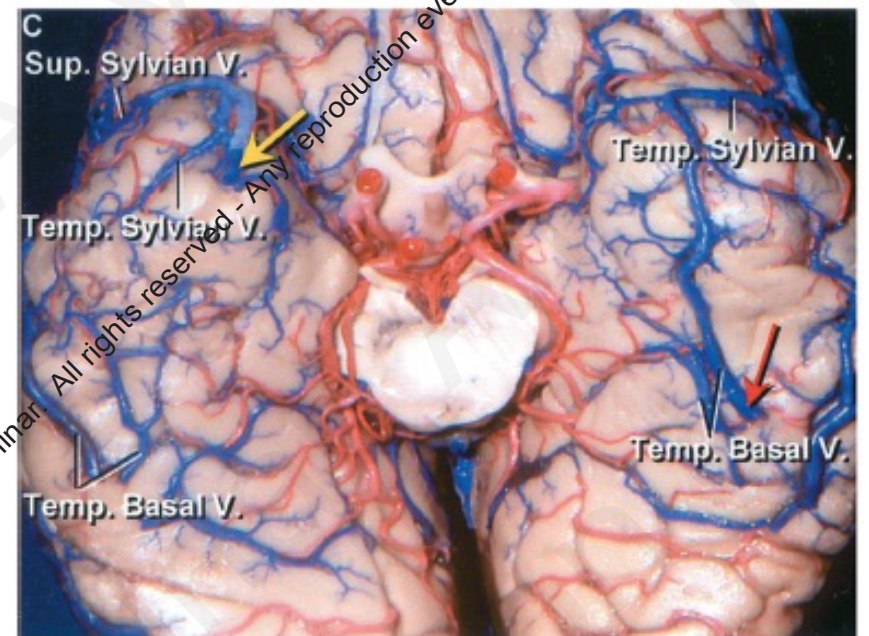
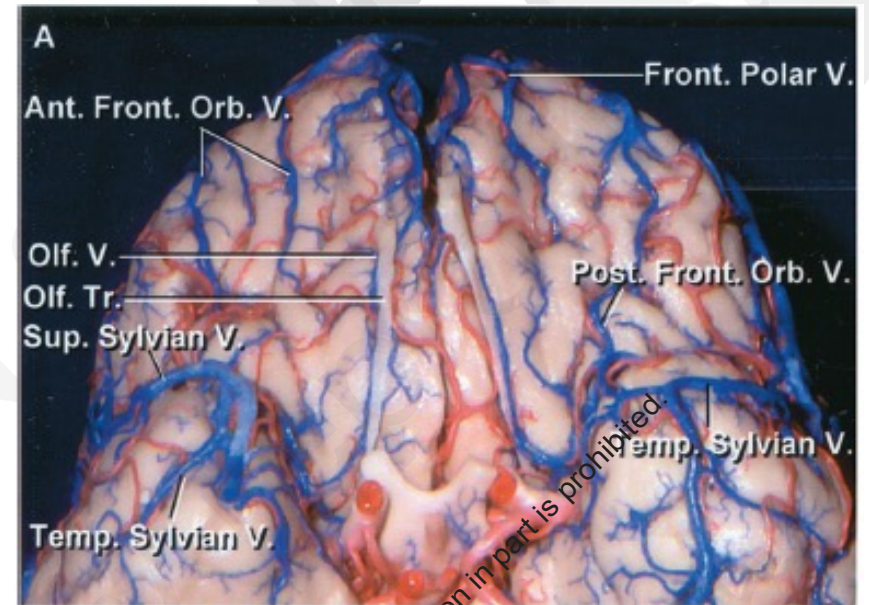
Anterior: towards SLS via fronto-polar veins

Most frequent

Posterior: via olfactory veins towards

- Basal vein
- cavernous sinus
- superficial or deep sylvian veins

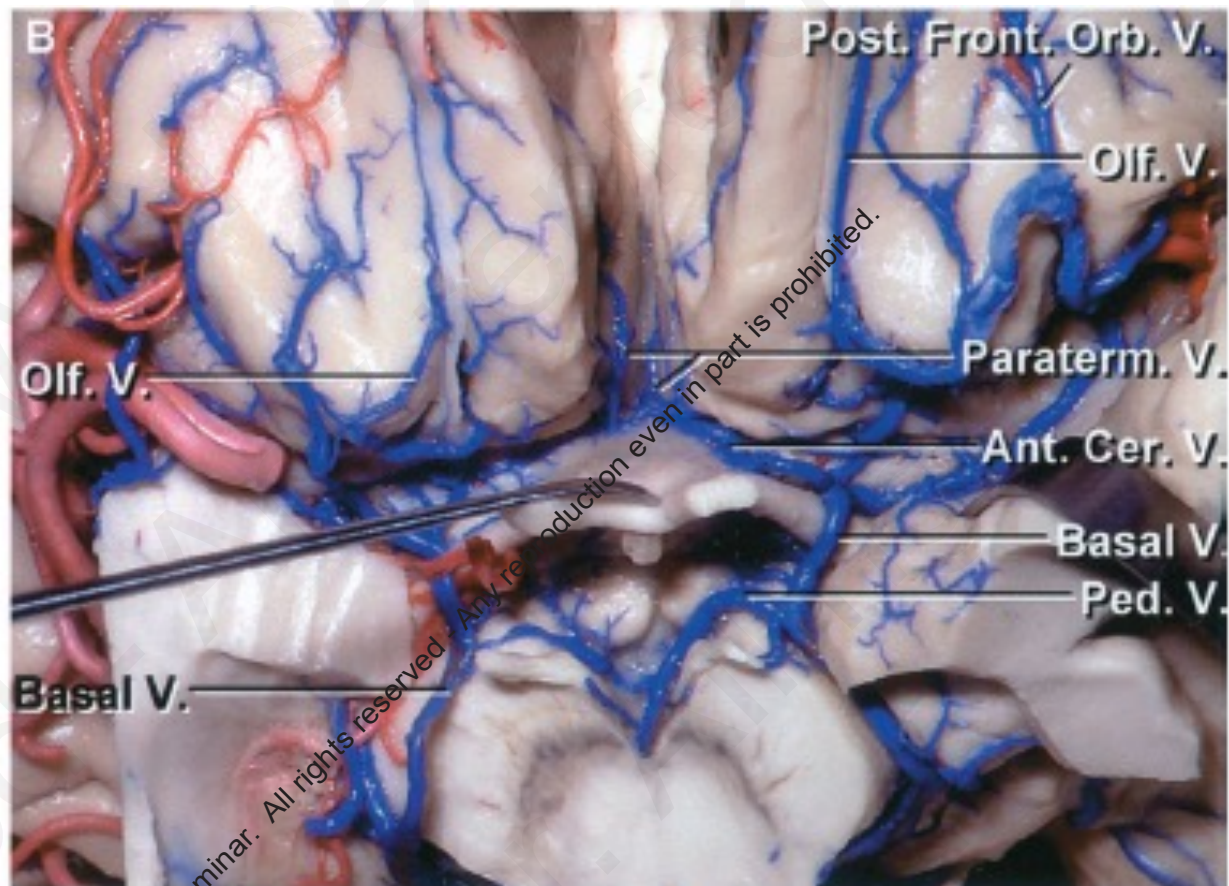
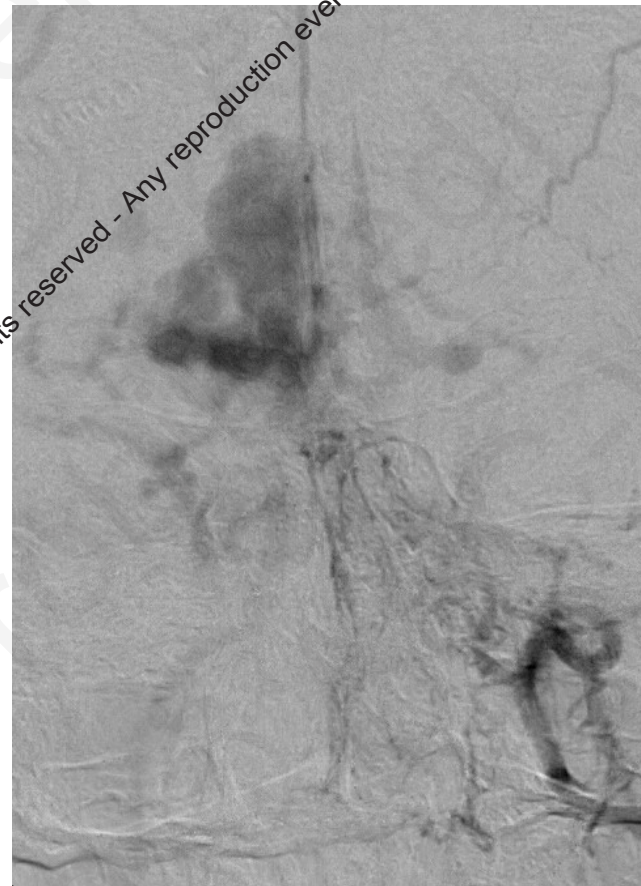
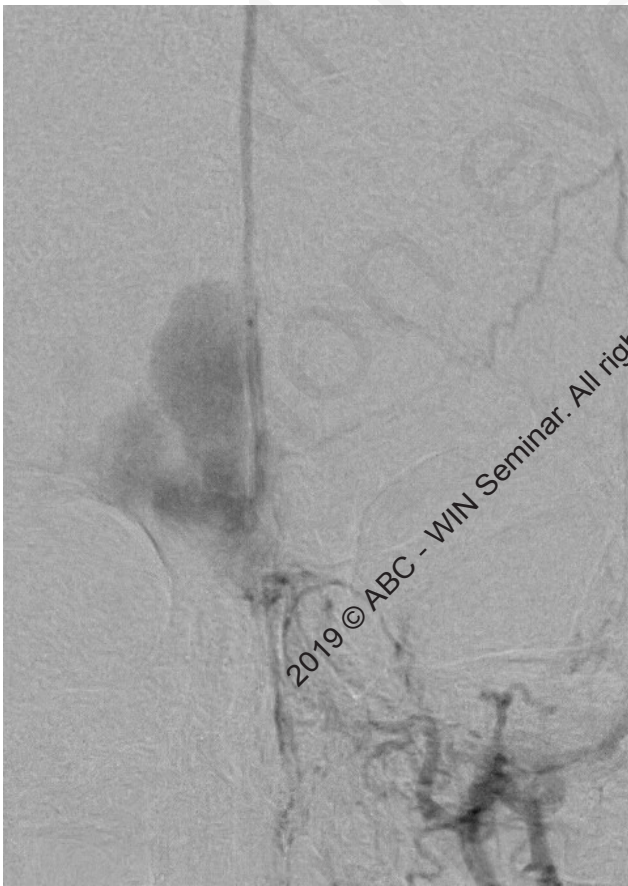
Both anterior and posterior



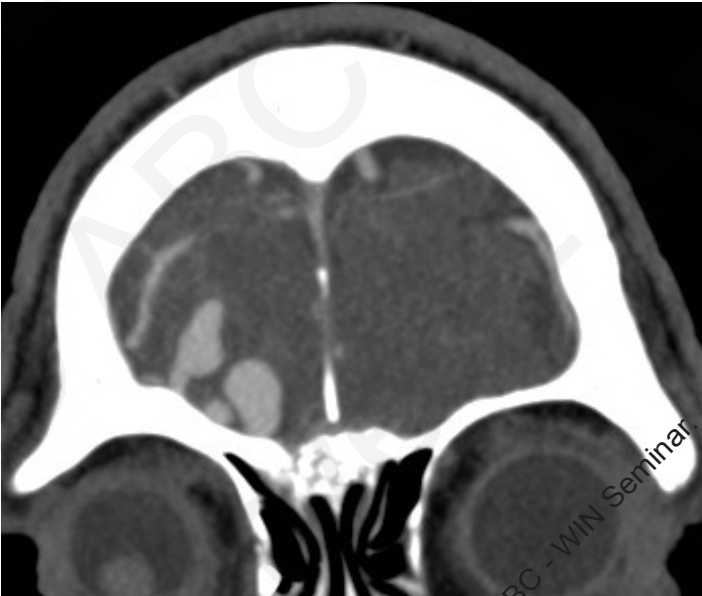
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Pathways of contralateral drainage in posterior venous drainage cases



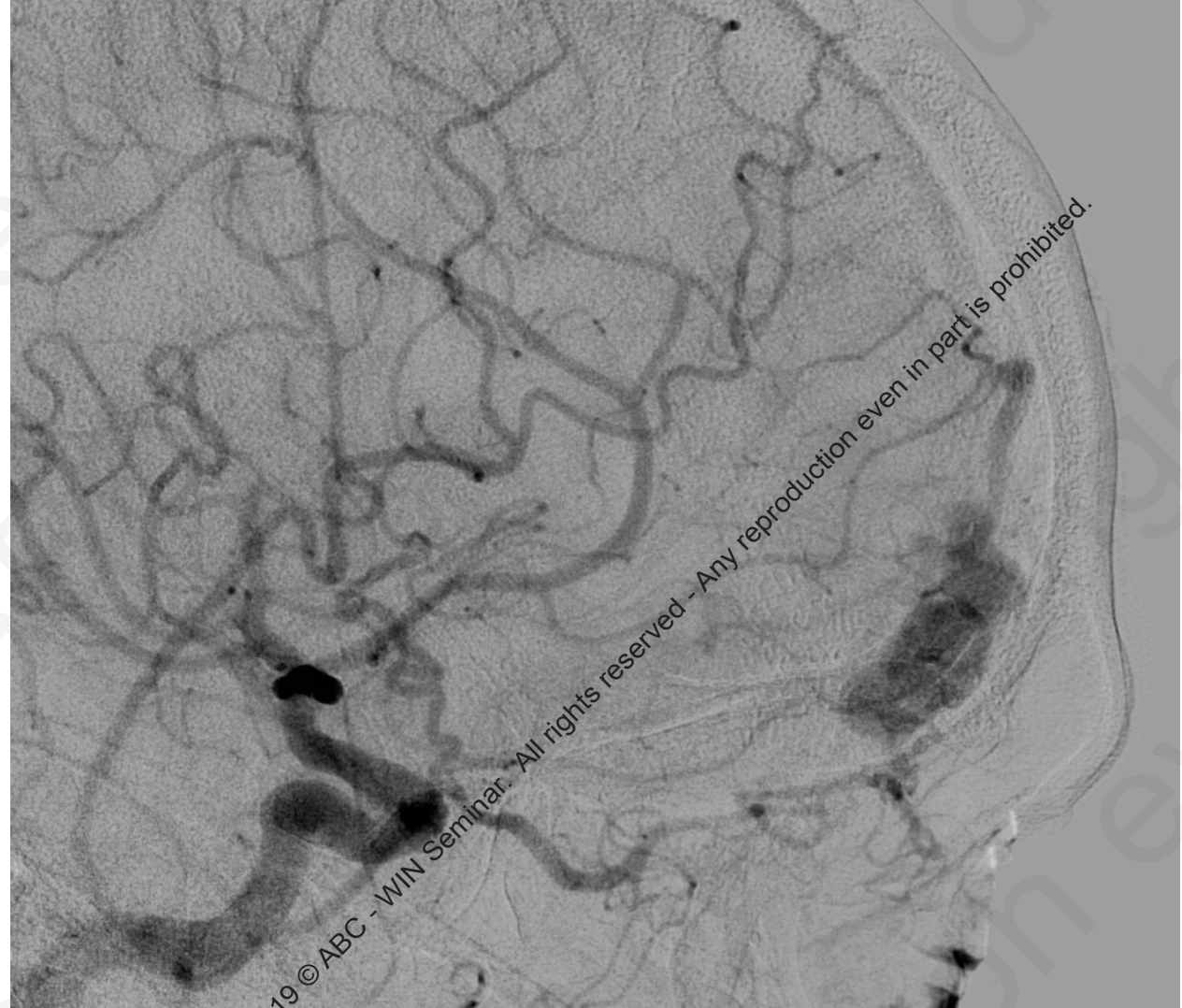
Anterior drainage



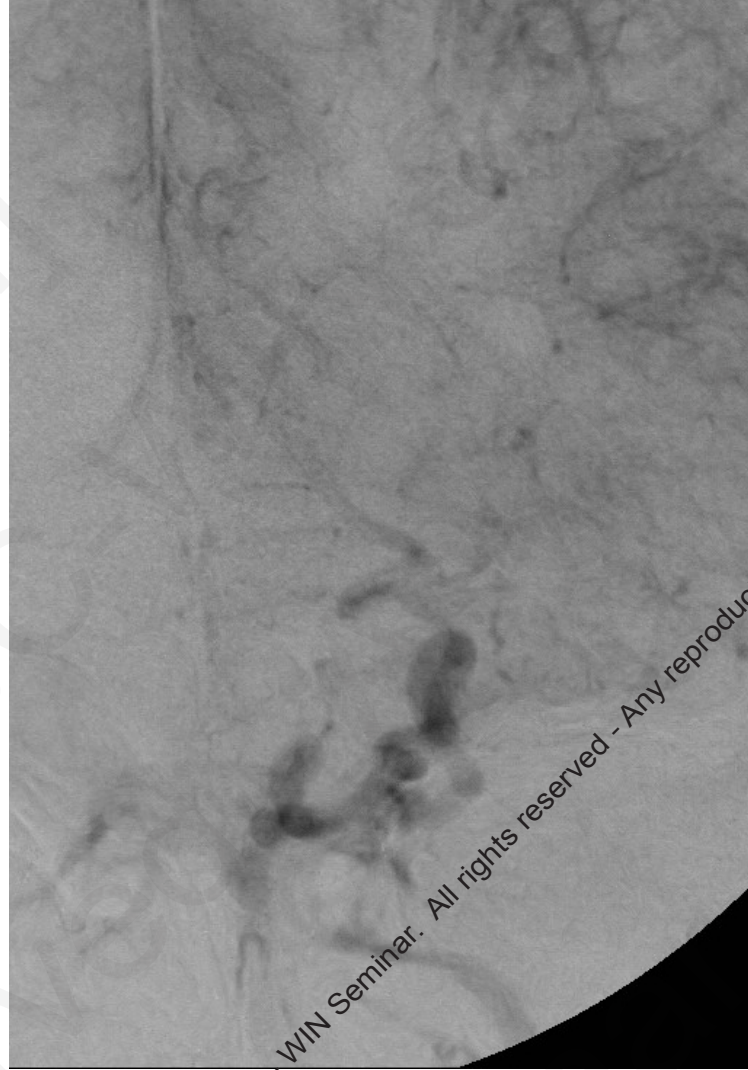
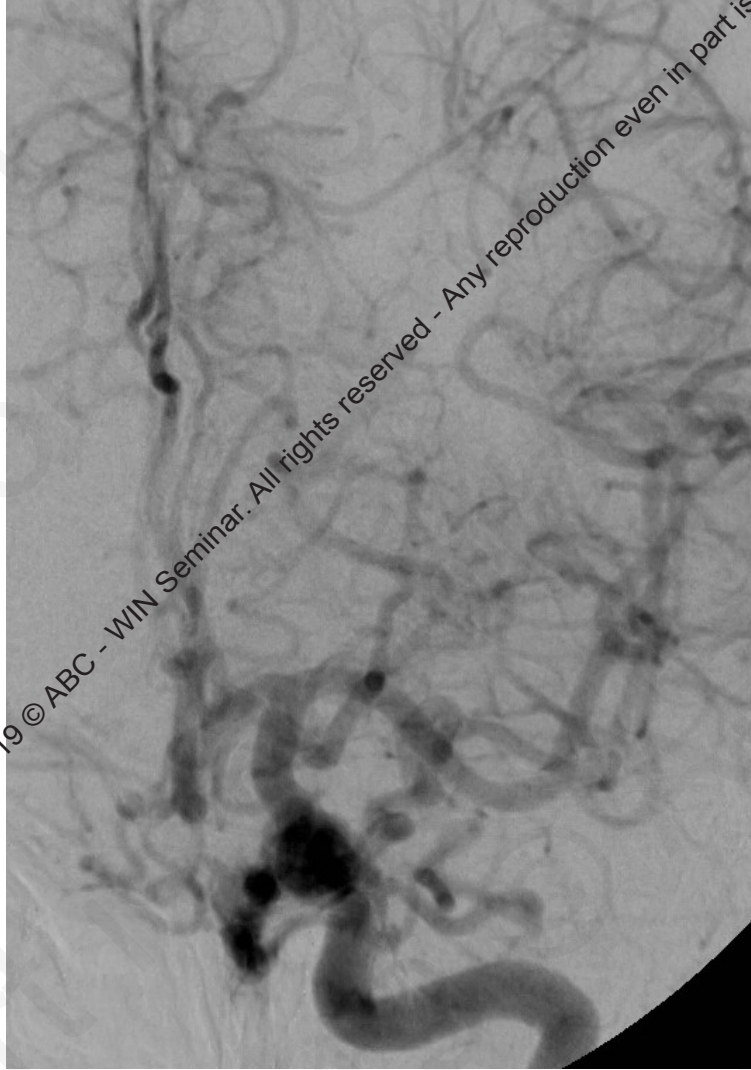
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

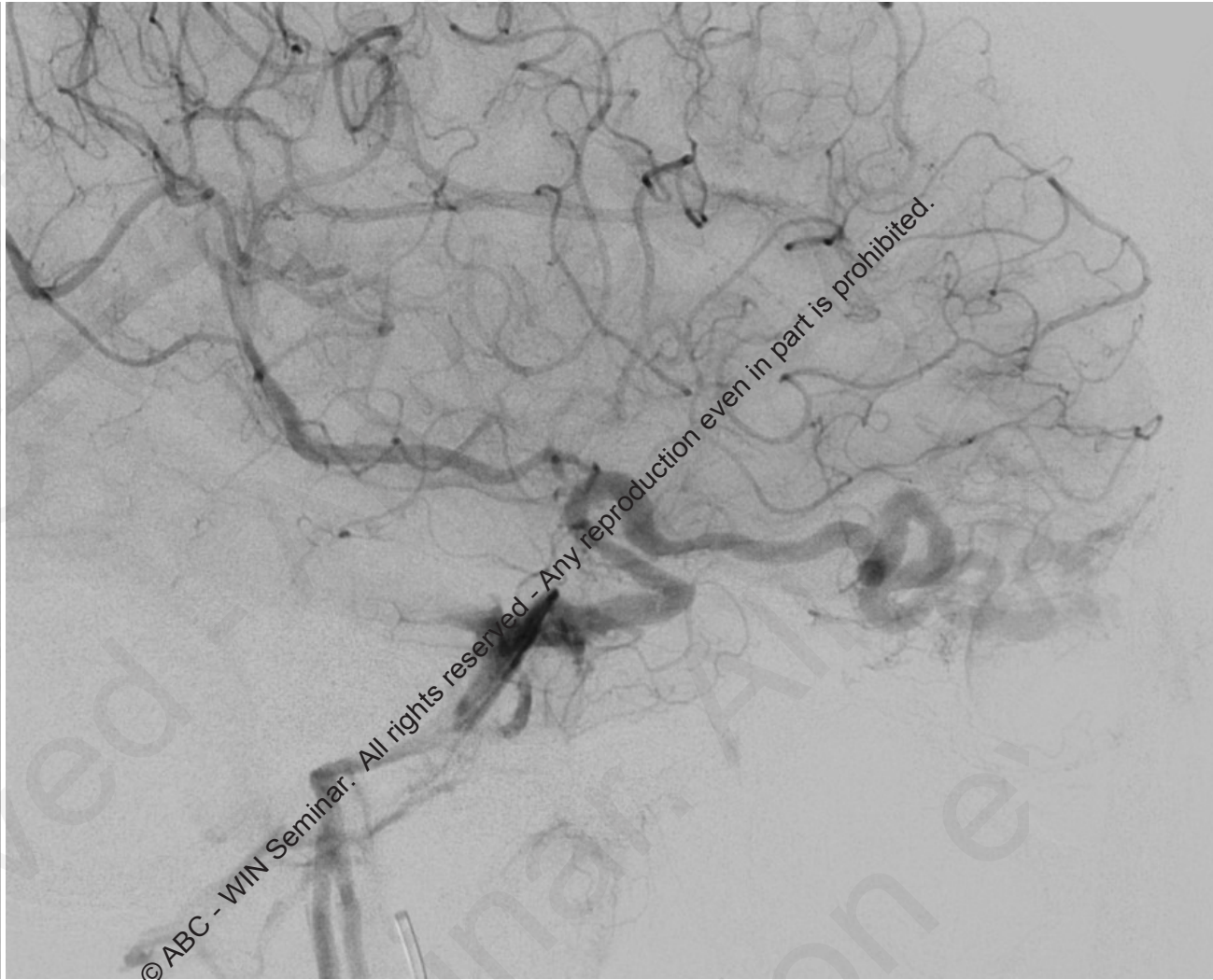
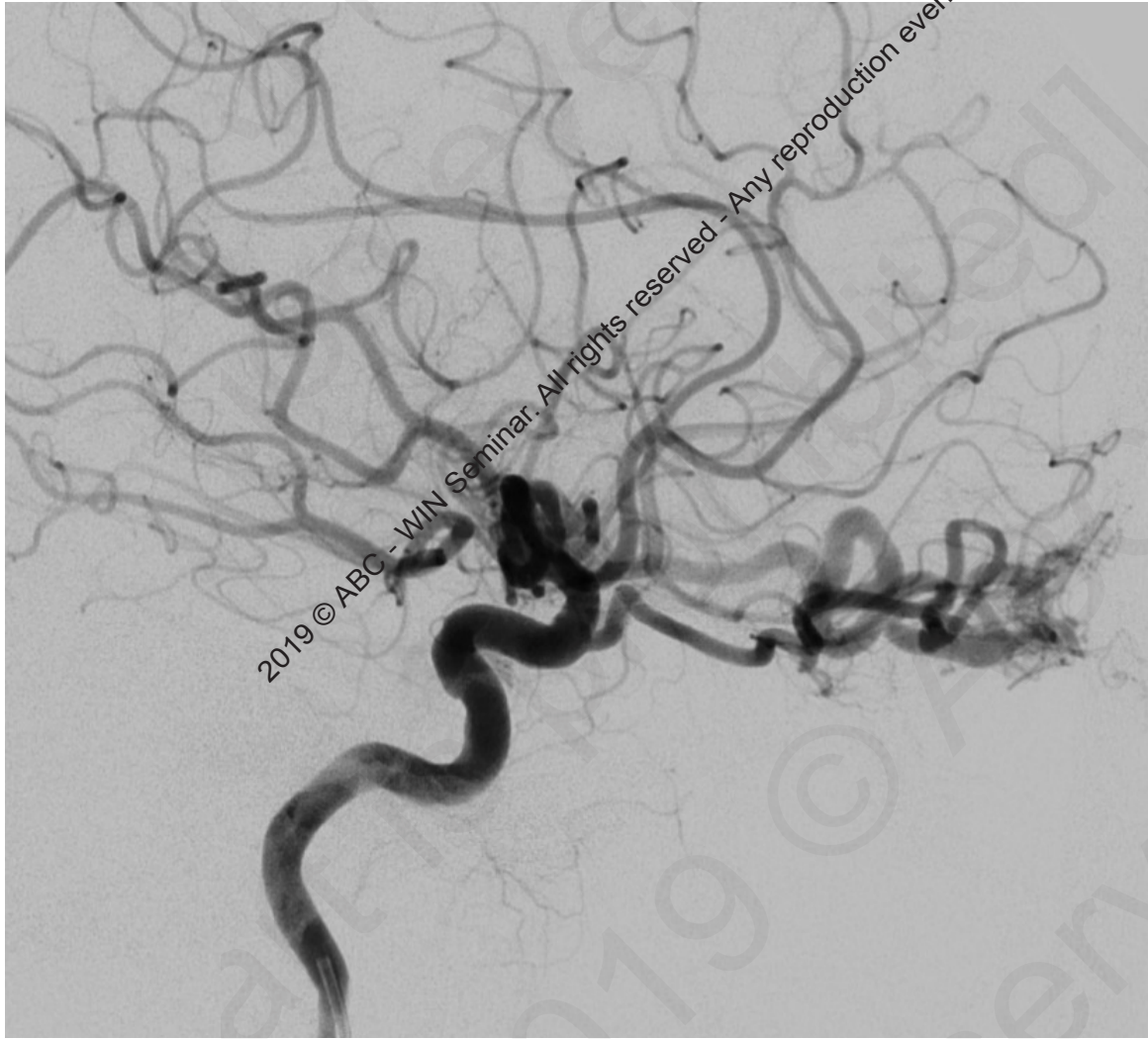
Anterior drainage

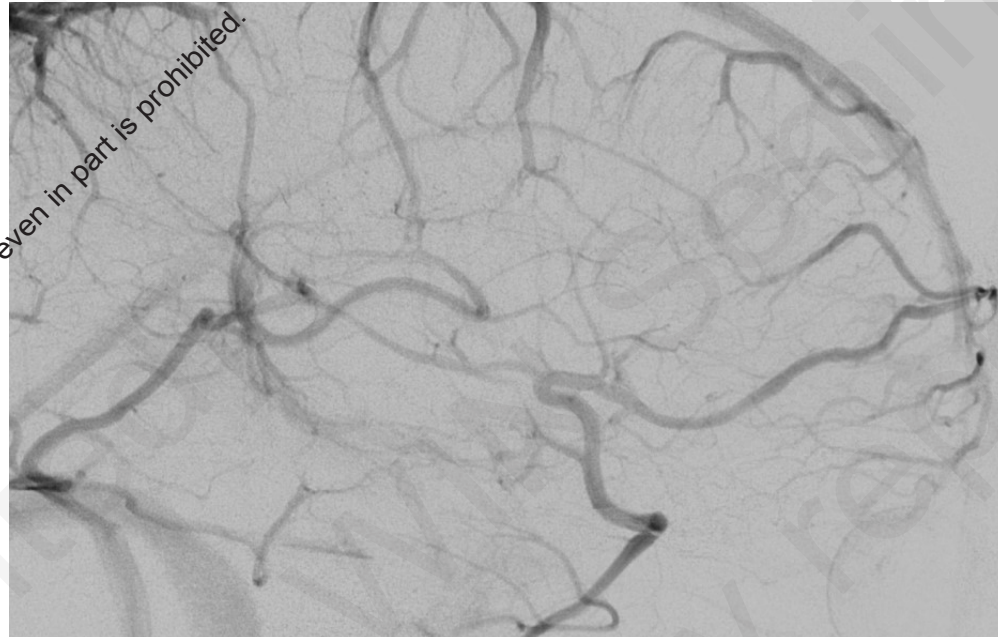
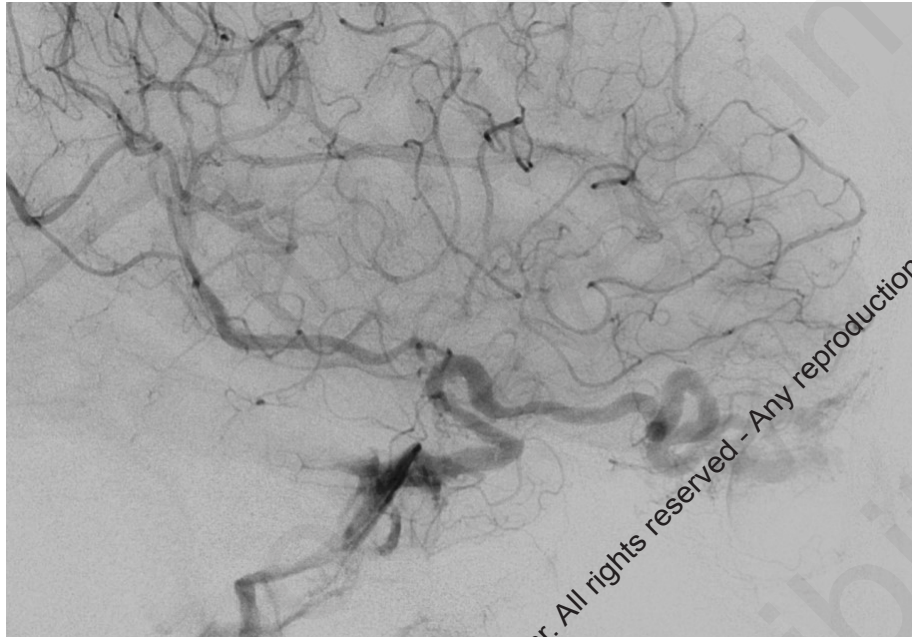


Posterior drainage

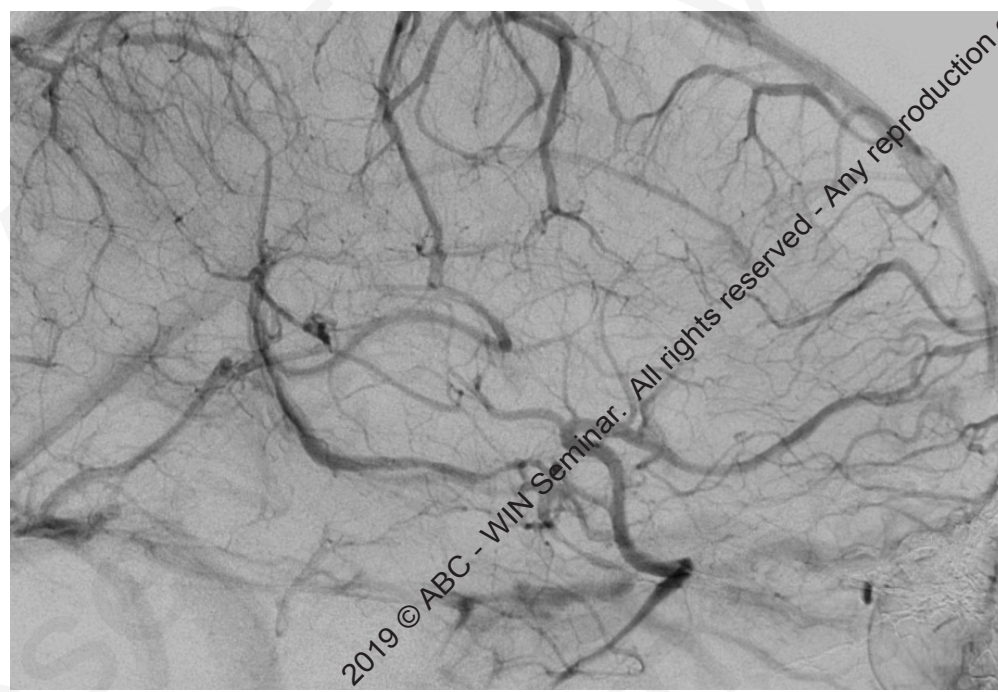
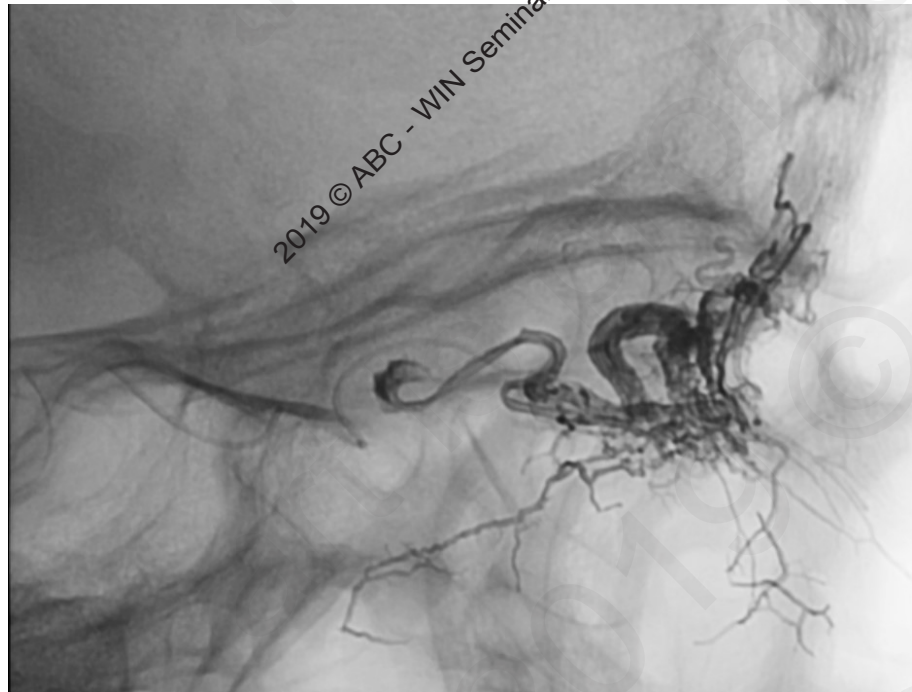


Posterior drainage



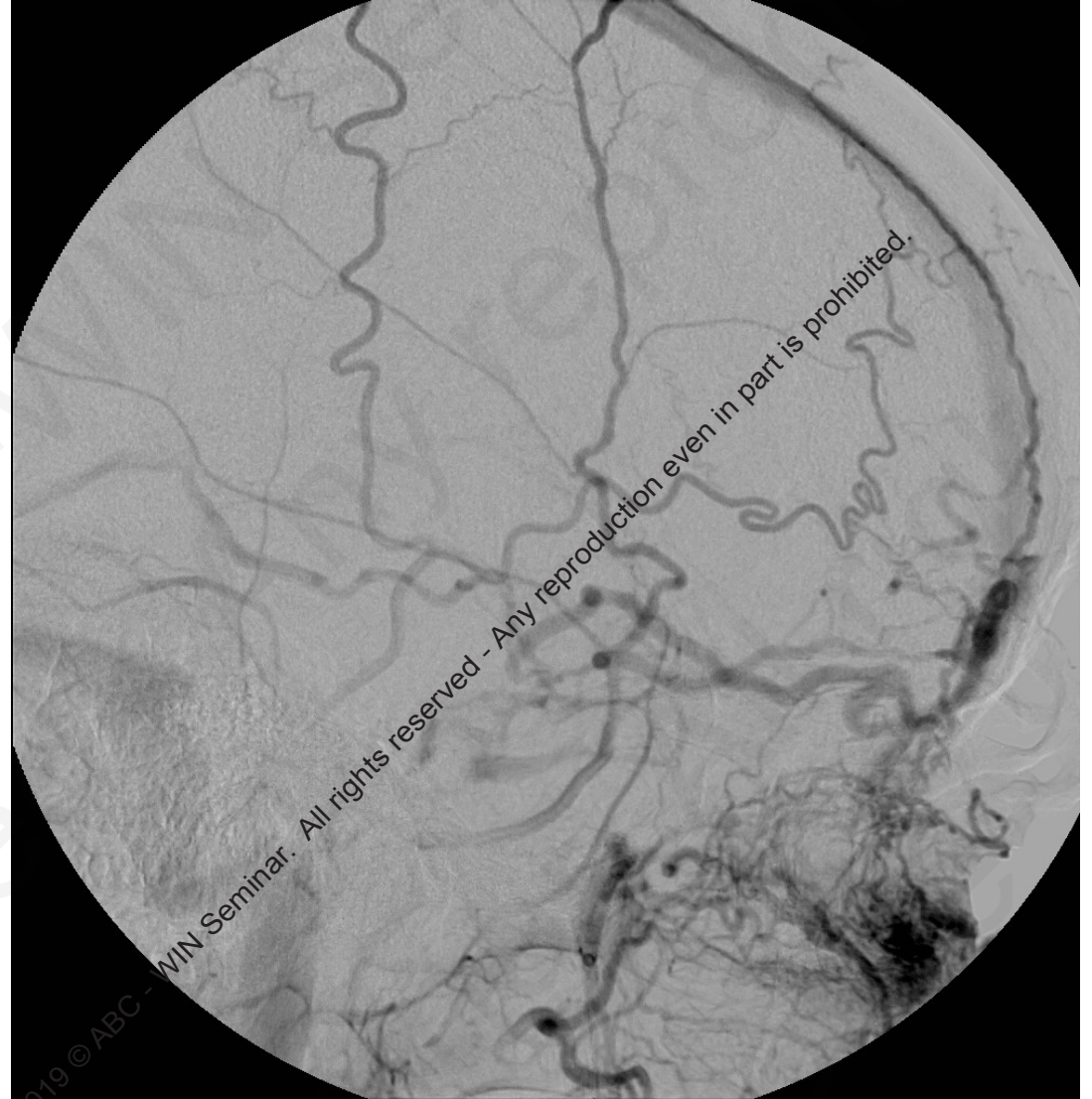


Before embo

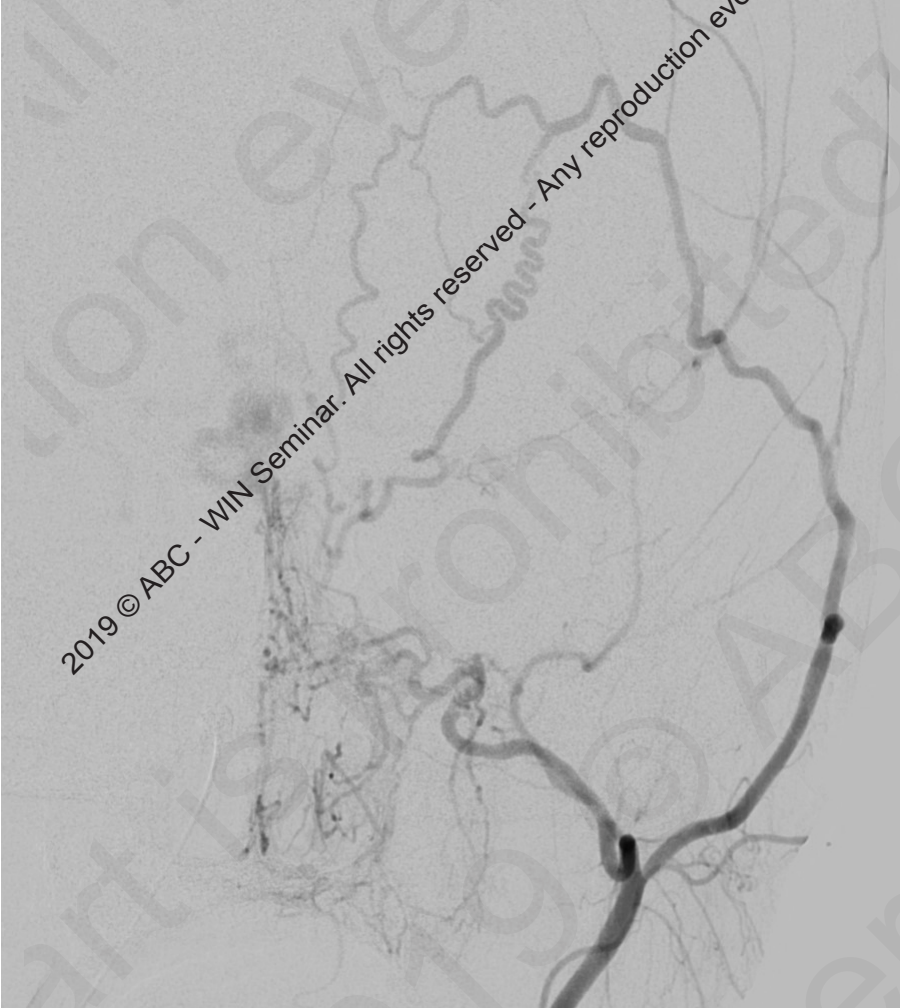


After embo

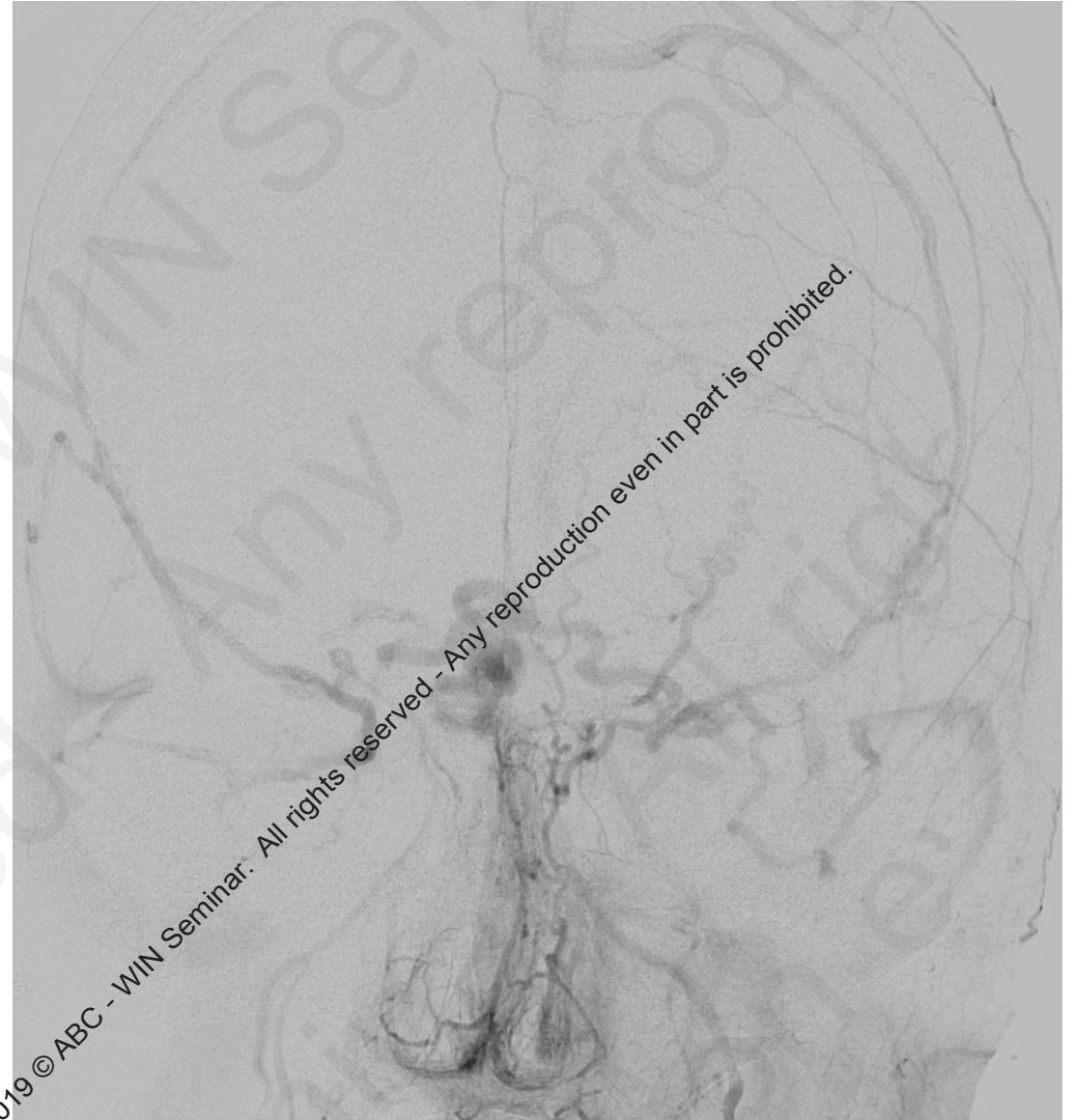
Both anterior and posterior



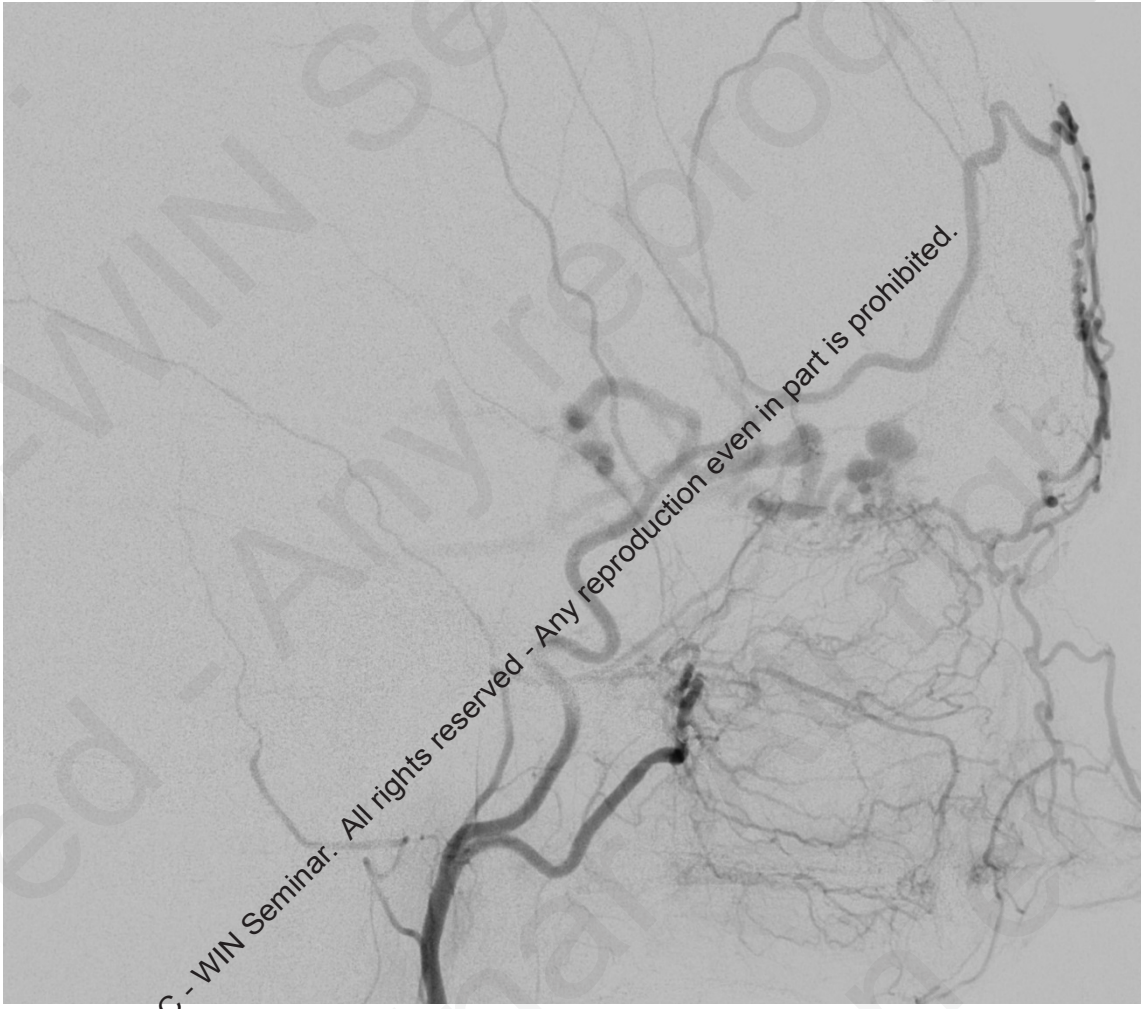
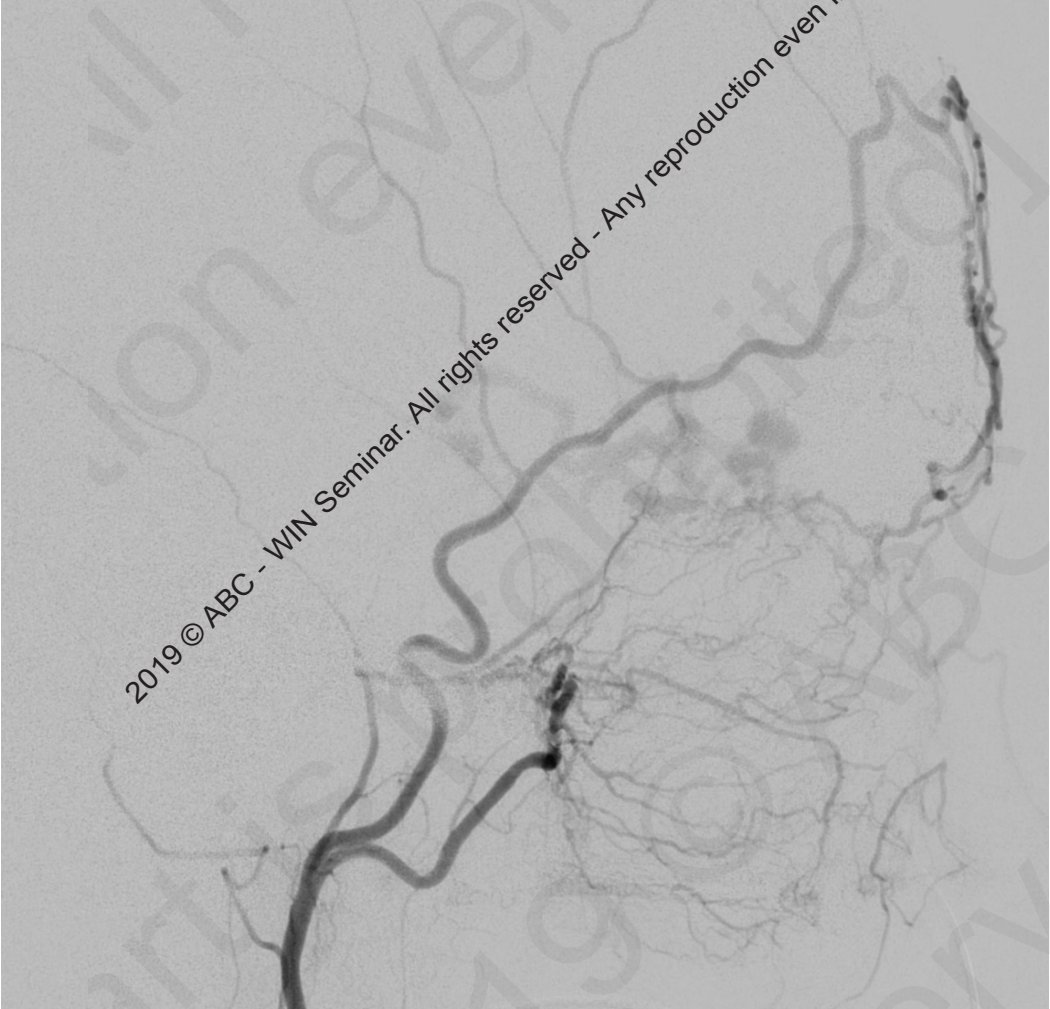
Contralateral drainage through Ant com vein



Contralateral drainage through Ant com vein



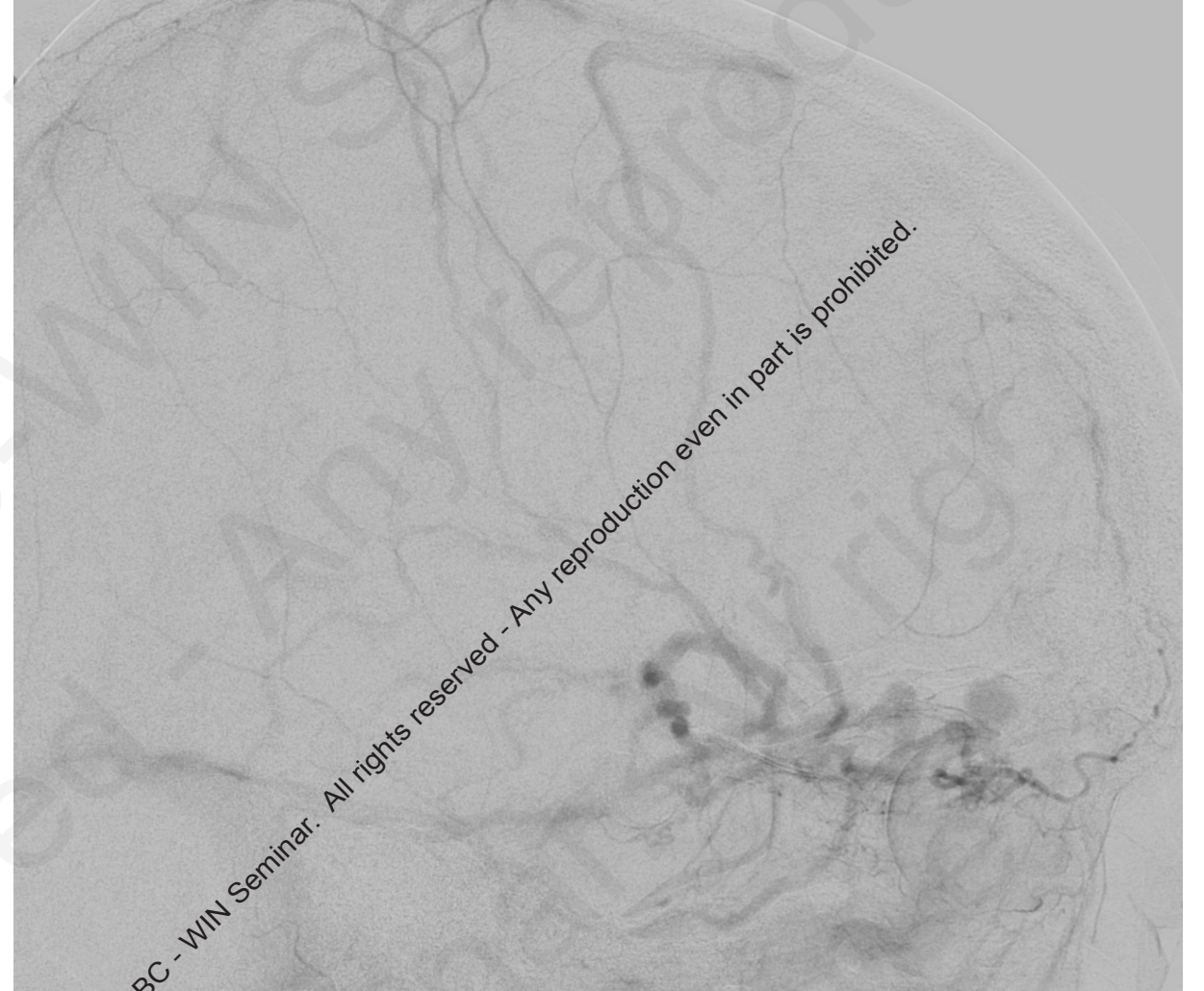
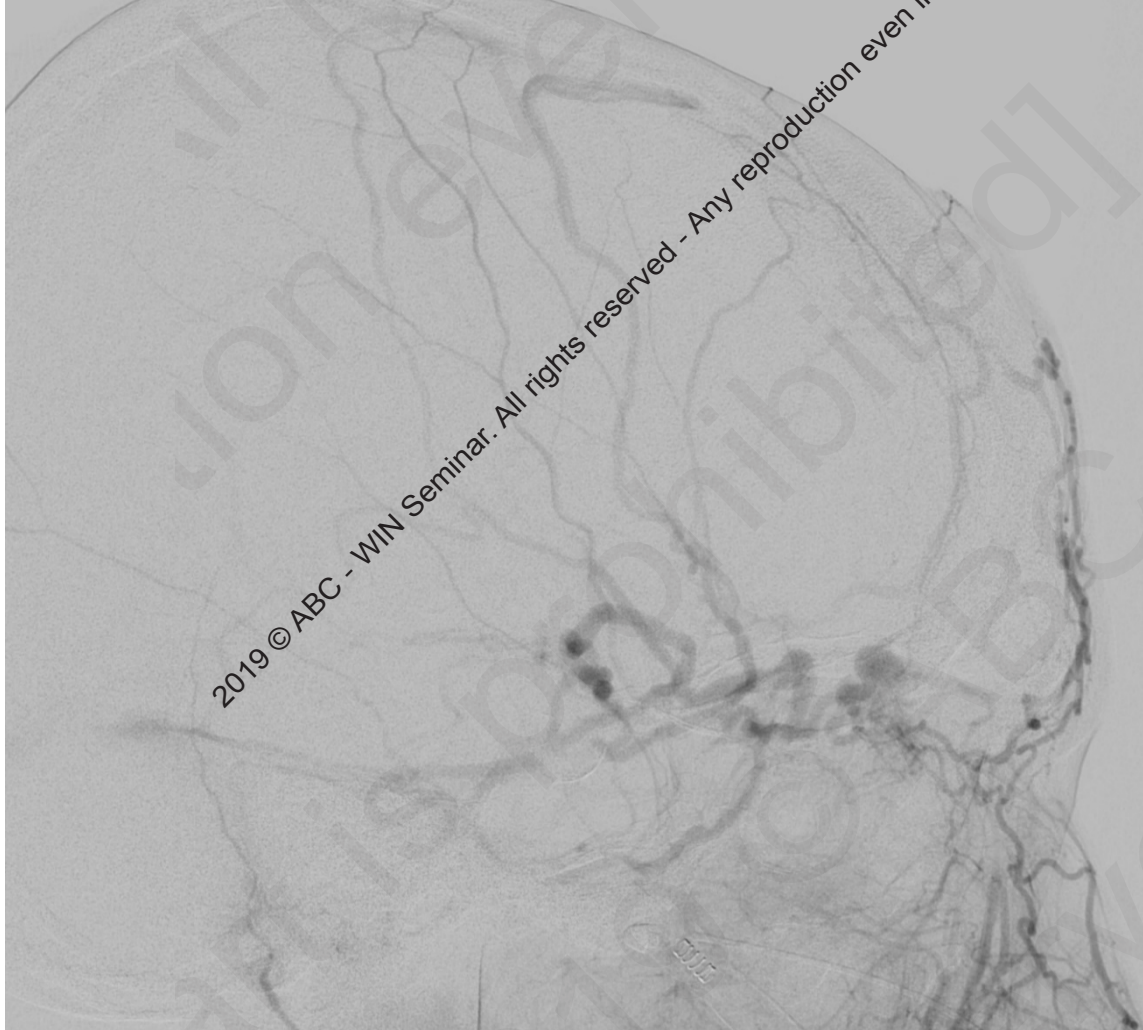
Contralateral drainage through Ant com vein



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Contralateral drainage through Ant com vein




Venous drainage and symptoms

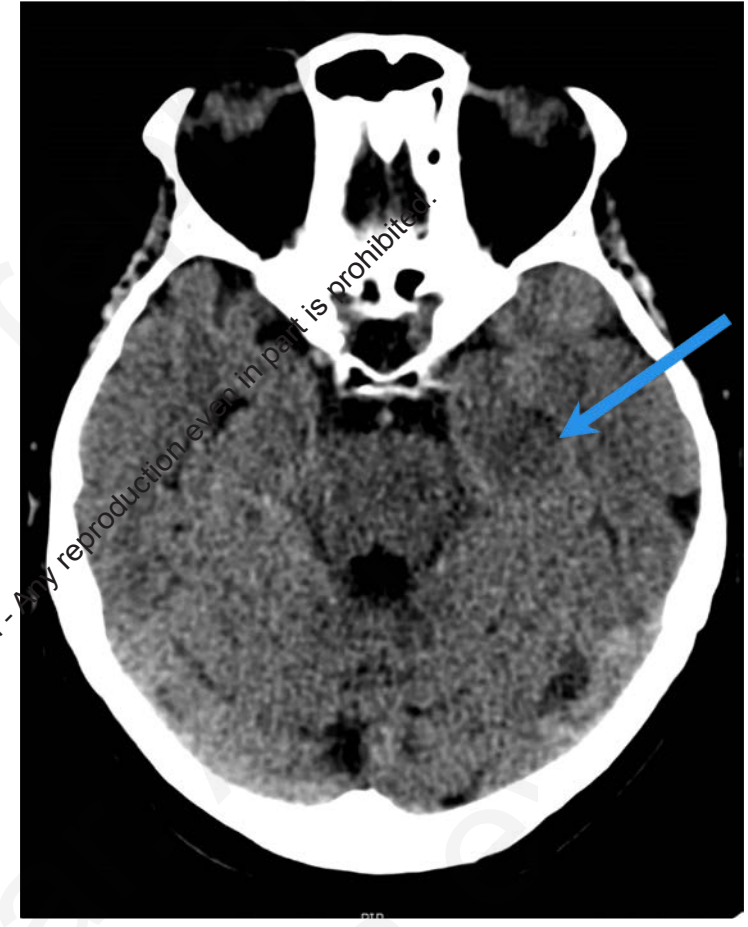
- 6 month history of progressive lower limb weakness
- Cognitive impairment

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



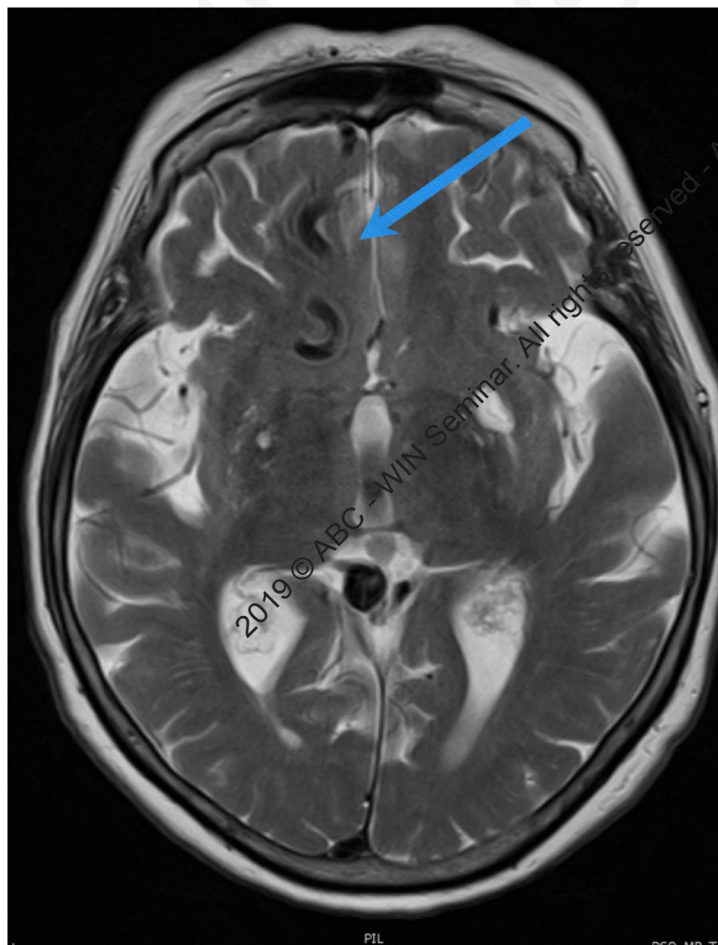
Plain CT-Scan



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

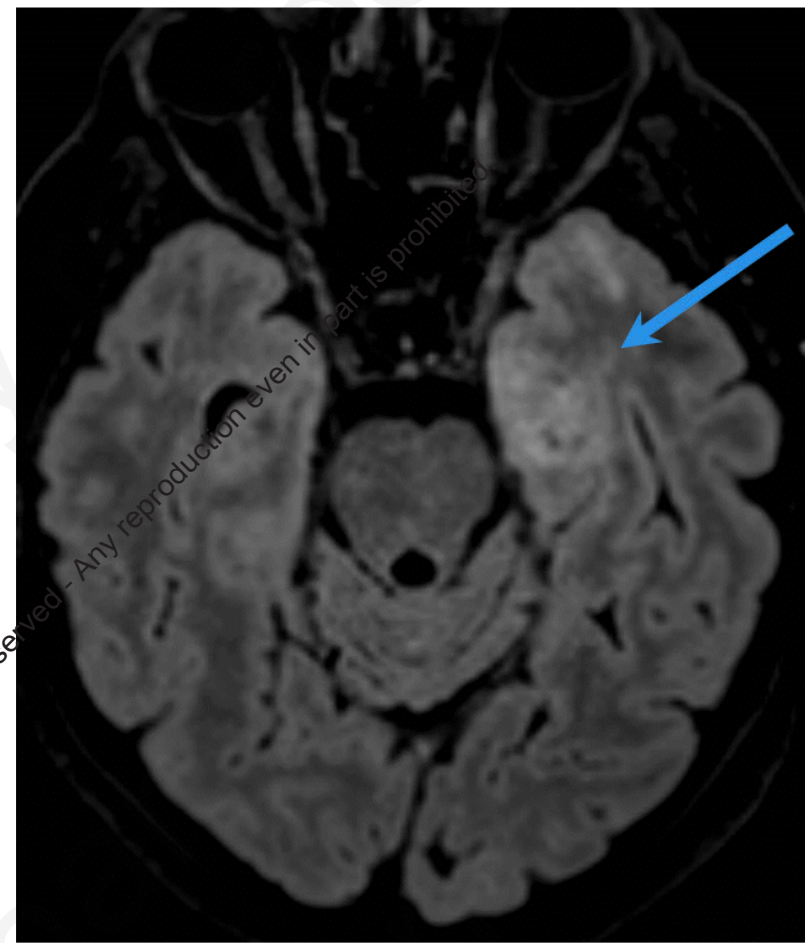
MRI



T2

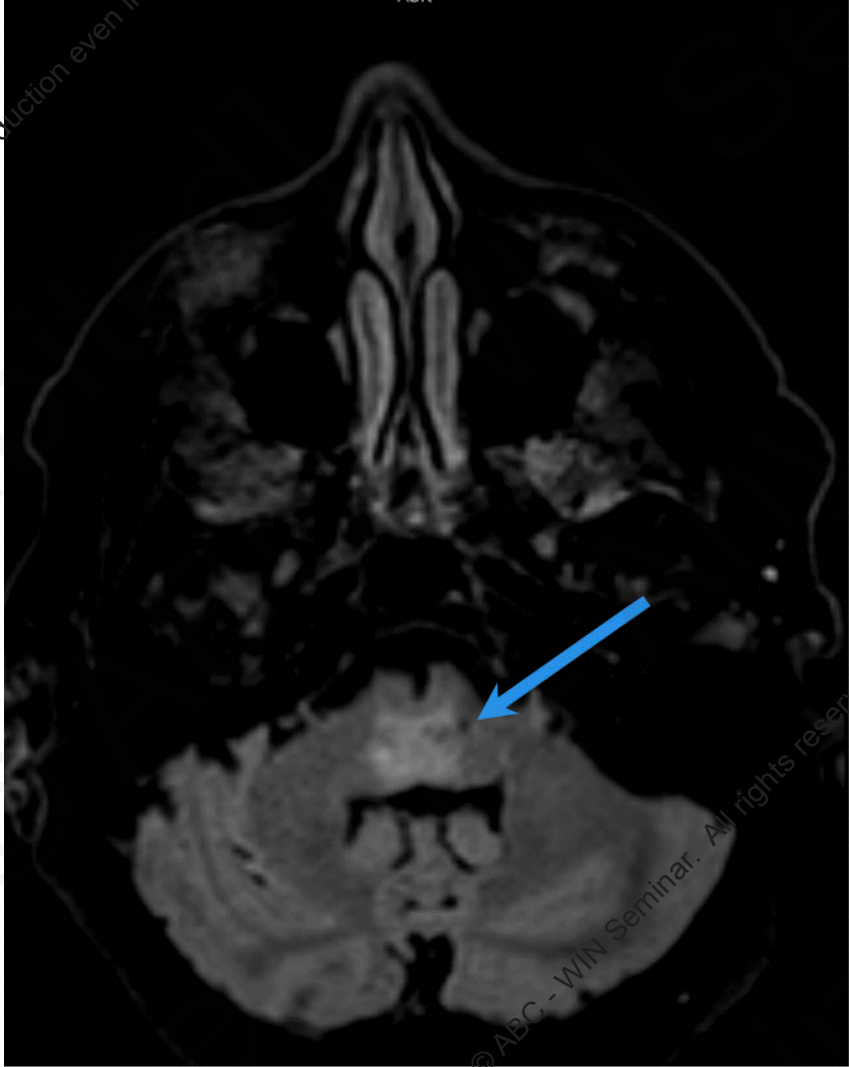
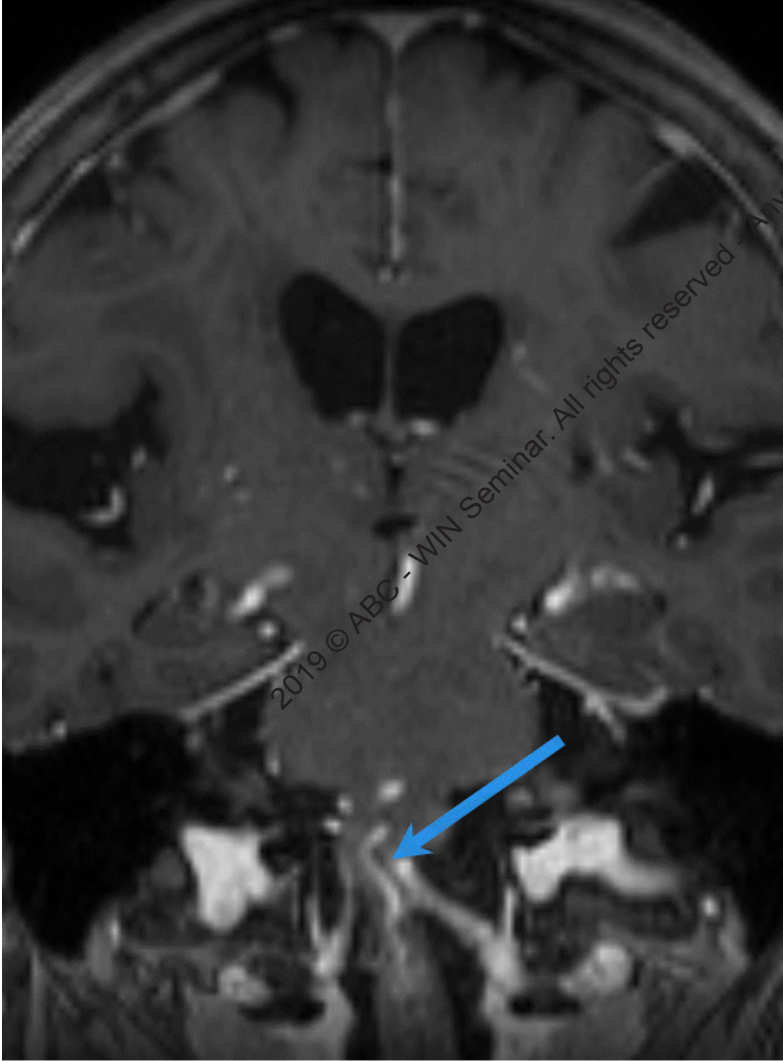


POST GADO



T2 FLAIR

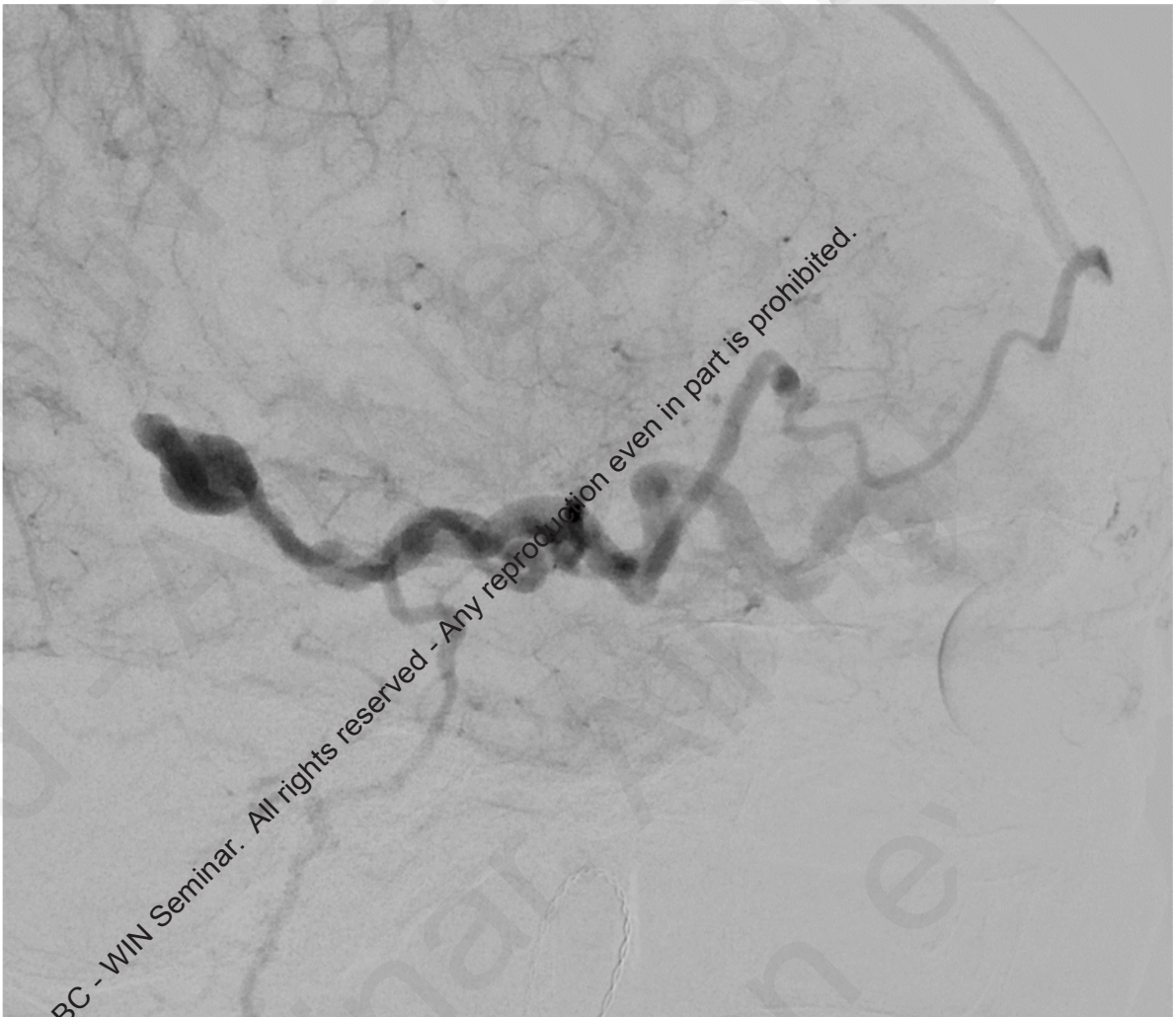
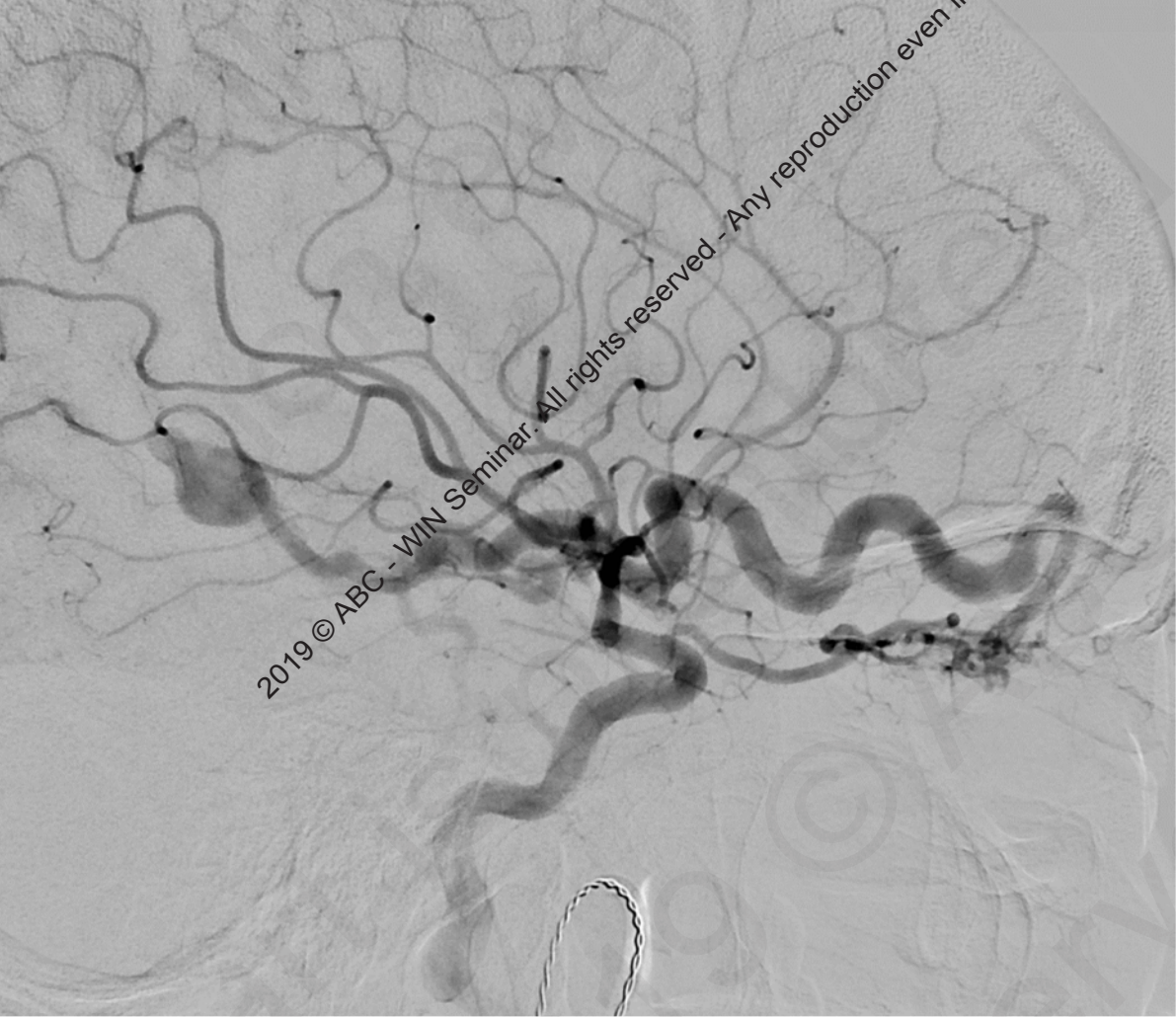
MRI



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Angiography



RICA 1st

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Angiography

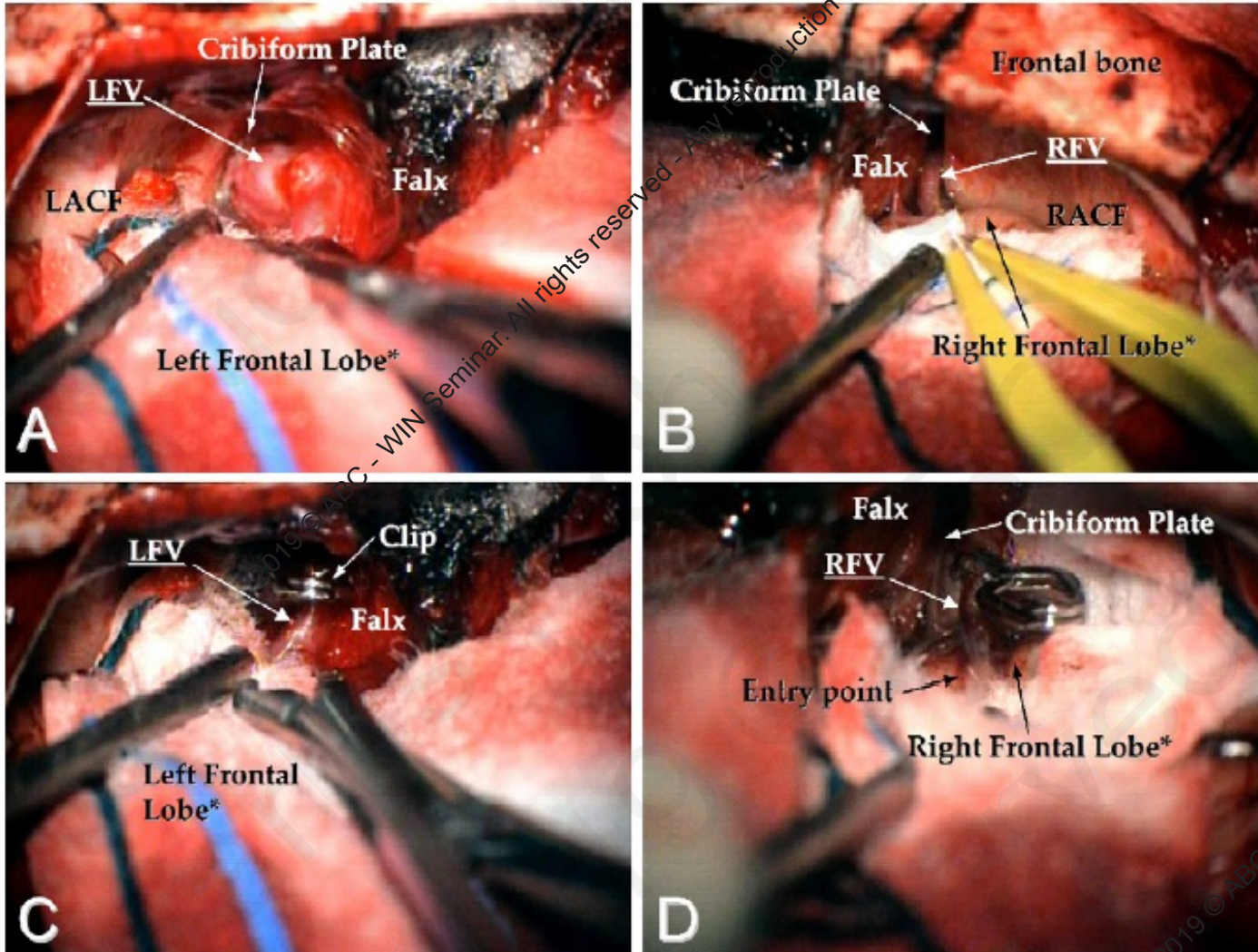


Case report

Bilateral ethmoidal dural arteriovenous fistula Unexpected surgical diagnosis

Javier Ros de San Pedro^{a,*}, Claudio J. Piqueras Pérez^a, Joaquín Zamorro Parra^b,
Antonio López López-Guerrero^a, Juan F. Martínez-Lage Sánchez^a

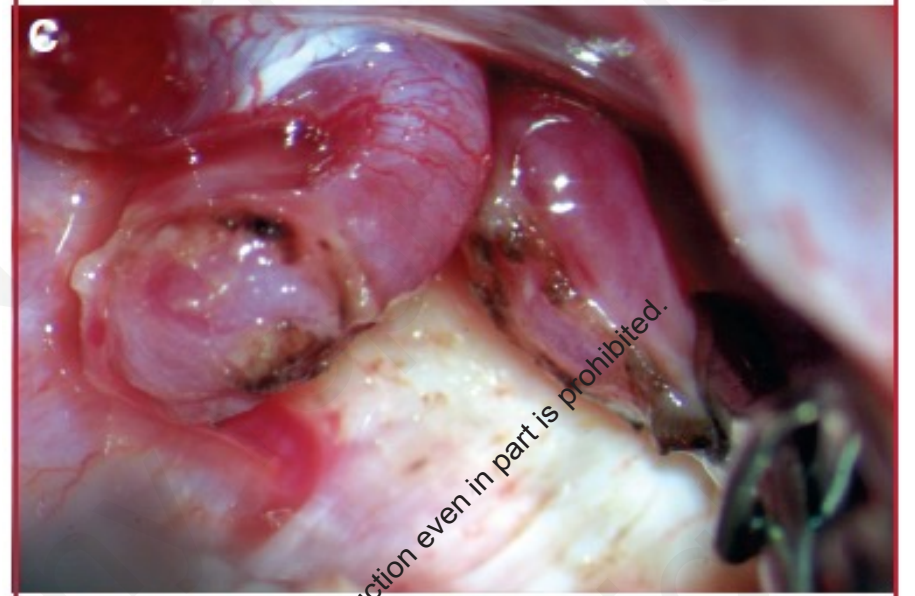
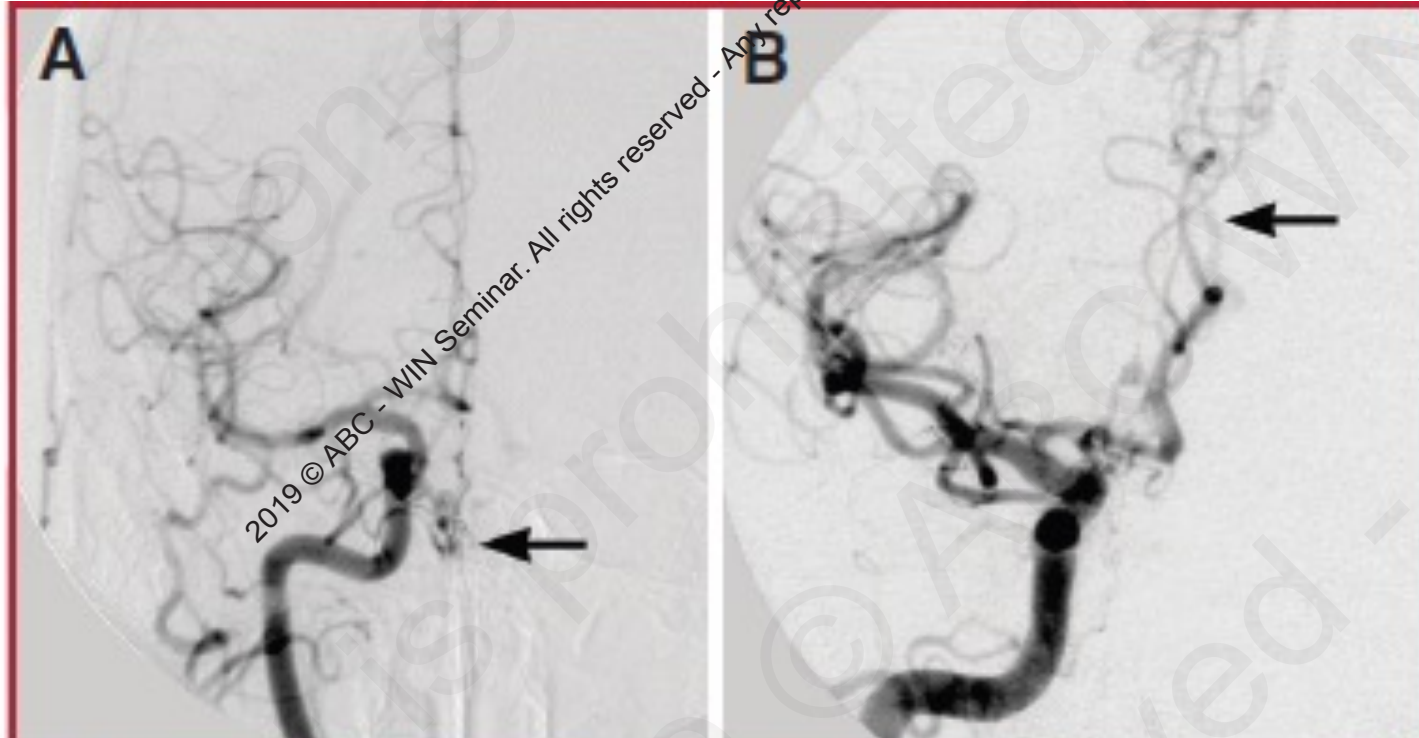
Clinical Neurology and Neurosurgery 112 (2010) 903–908



Any reproduction even in part is prohibited.

SURGICAL TREATMENT OF HIGH-RISK INTRACRANIAL DURAL ARTERIOVENOUS FISTULAE: CLINICAL OUTCOMES AND AVOIDANCE OF COMPLICATIONS

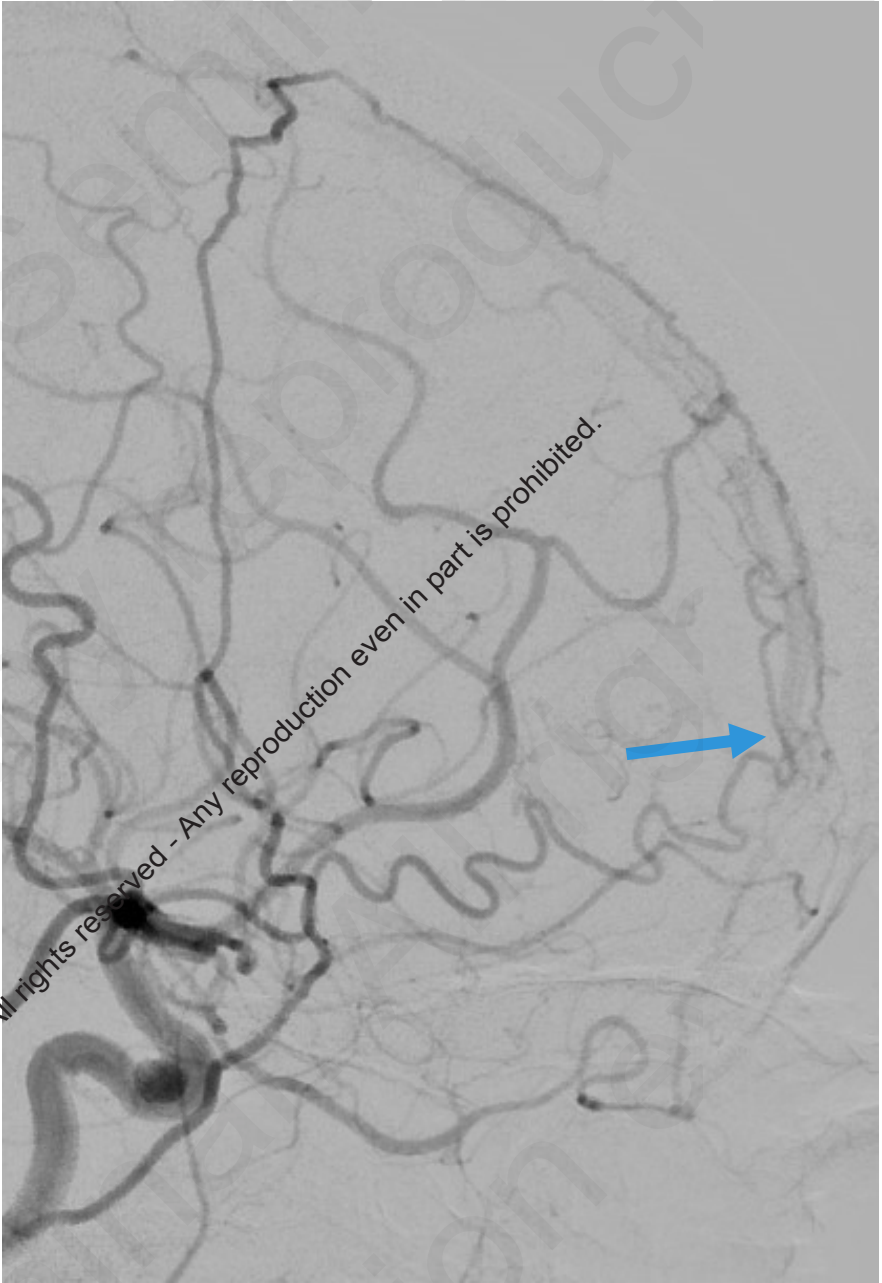
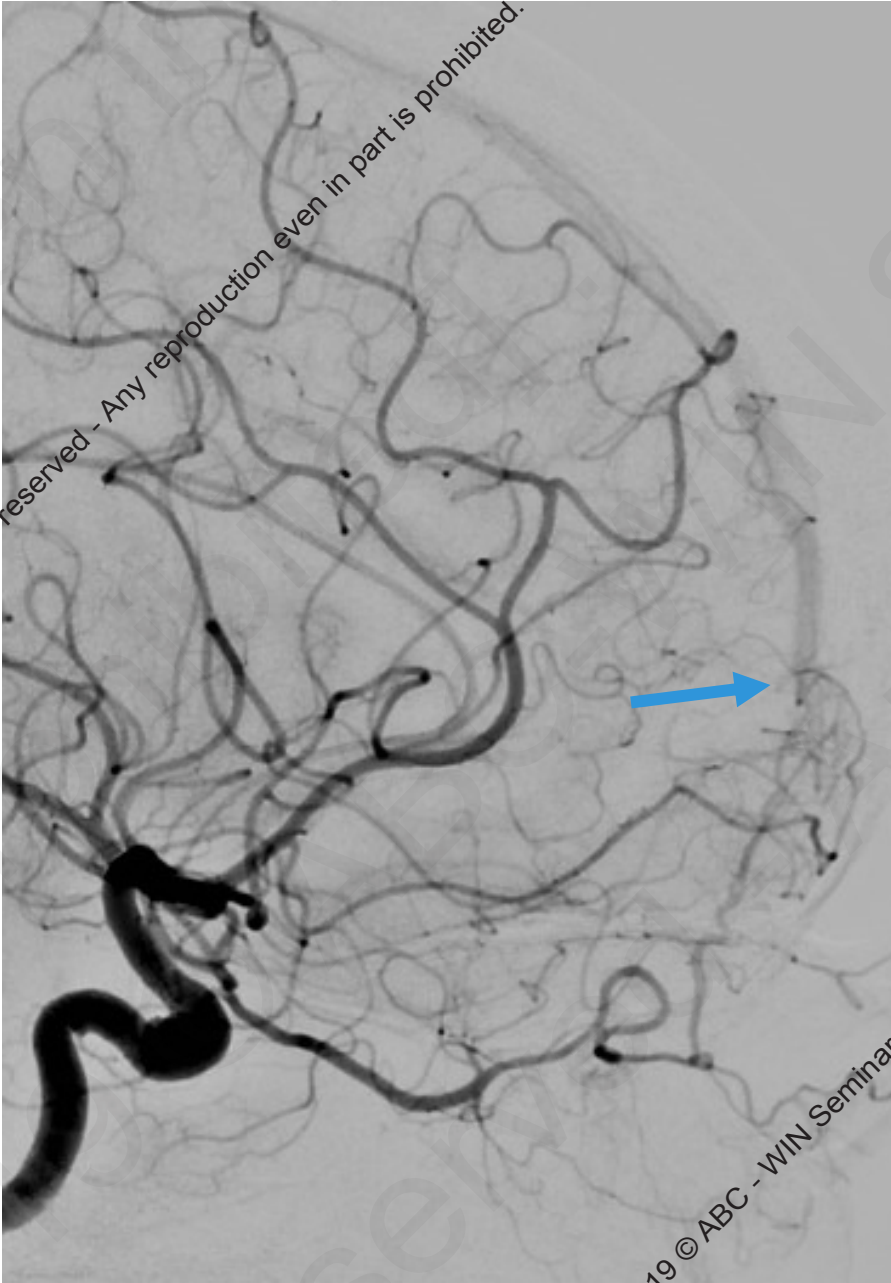
Neurosurgery 61:447-459, 2007



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

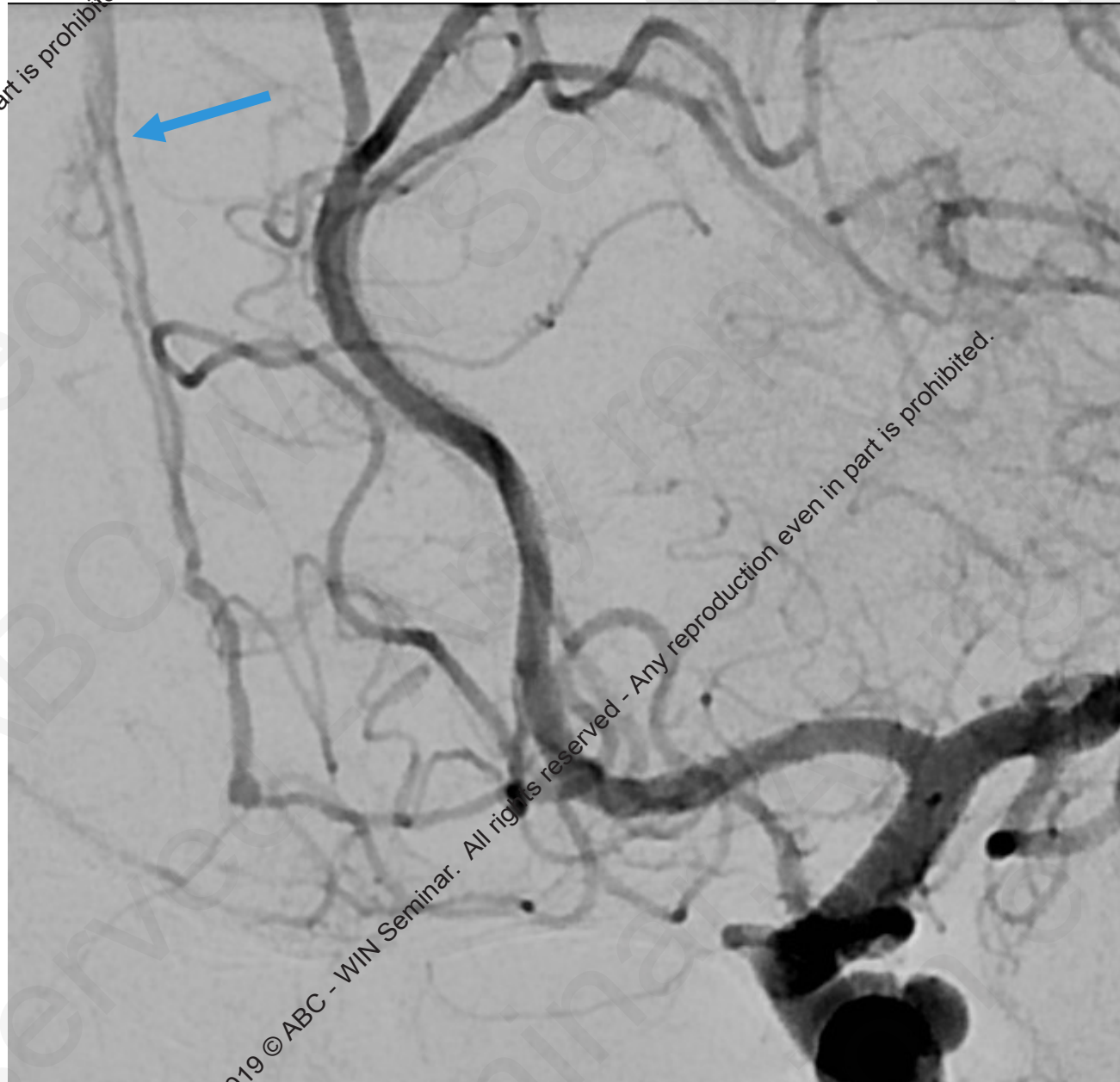
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Type I DAVF of the anterior SLS



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



Management

Principle: venous disconnection

Means:

- Open surgery
 - Orbito-frontal (lateral)
 - Trans frontal sinus
 - Bi-frontal inter-hemispheric
 - Supra-orbital (eyebrow incision)
- Endovascular
 - Trans arterial
 - Trans venous
 - Coils
 - Onyx



Management strategies for anterior cranial fossa (ethmoidal) dural arteriovenous fistulas with an emphasis on endovascular treatment

Clinical article

RONIT AGID, M.D.,¹ KAREL TERBRUGGE, M.D.,¹ GEORGES RODESCH, M.D., PH.D.,²
TOMMY ANDERSSON, M.D., PH.D.,³ AND MICHAEL SÖDERMAN, M.D., PH.D.³

- 24 patients from 3 institutions over 23 years
- Clinical presentation : hemorrhage in 45,8%, fortuitous in 25%
- Treatment:
 - Surgery 15 cases (4 after endovascular attempt)
 - Endovascular : 7 cases (O.A. with glue)
 - Radiosurgery: 2 cases
- All cases cured but 1 had no f-up (radiosurgery)
- No permanent complication

Clinical and Anatomic Insights From a Series of Ethmoidal Dural Arteriovenous Fistulas at Barrow Neurological Institute

Bradley A. Gross, Karam Moon, M. Yashar S. Kalani, Felipe C. Albuquerque, Cameron G. McDougall, Peter Nakaji, Joseph M. Zabramski, Robert F. Spetzler

- 27 patients over 15 years
- Clinical presentation: not mentioned
- Venous drainage: anterior (70%), posterior (30%)
- Treatment:
 - Surgery: 24 (6 after endovascular attempt)
 - Endovascular: 2 (1 trans arterial, 1 trans venous)
 - 1 patient refused surgery after endovascular failure
- 26 cures
- No permanent complication

Journal of Clinical Neuroscience 20 (2013) 287–291

Clinical Study

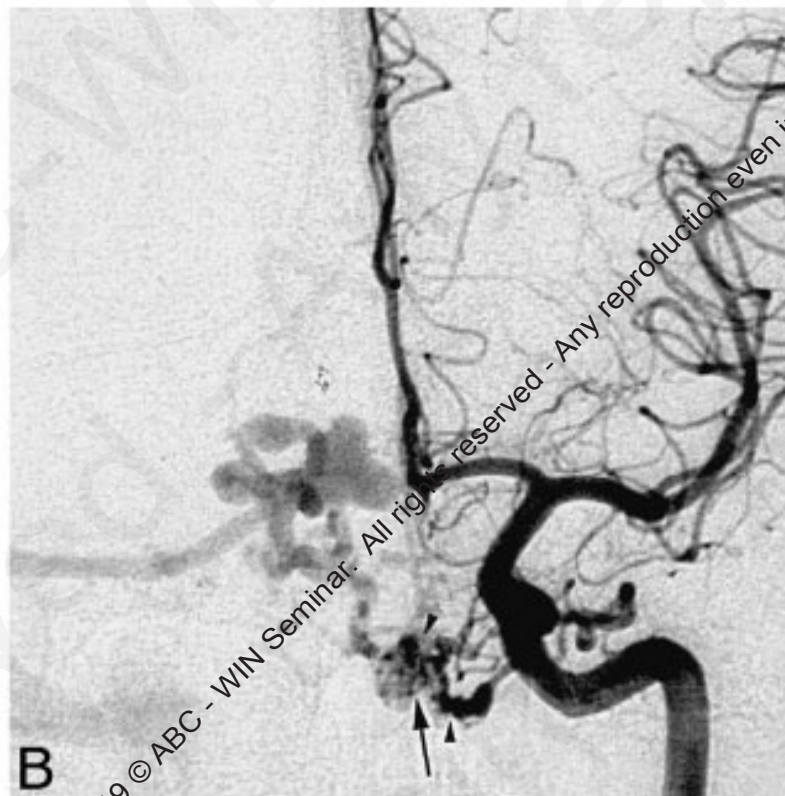
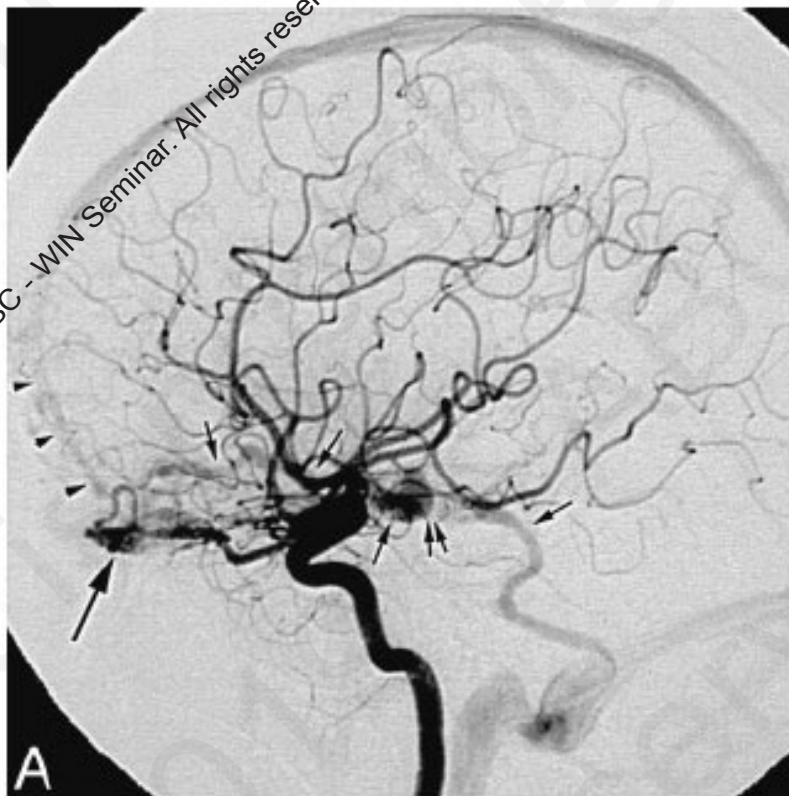
Transarterial embolization of dural arteriovenous fistulas of the anterior cranial fossa with Onyx

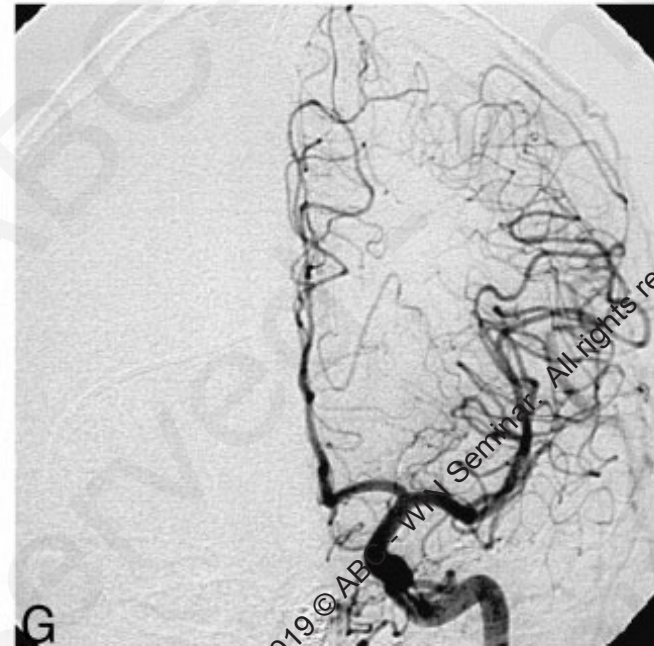
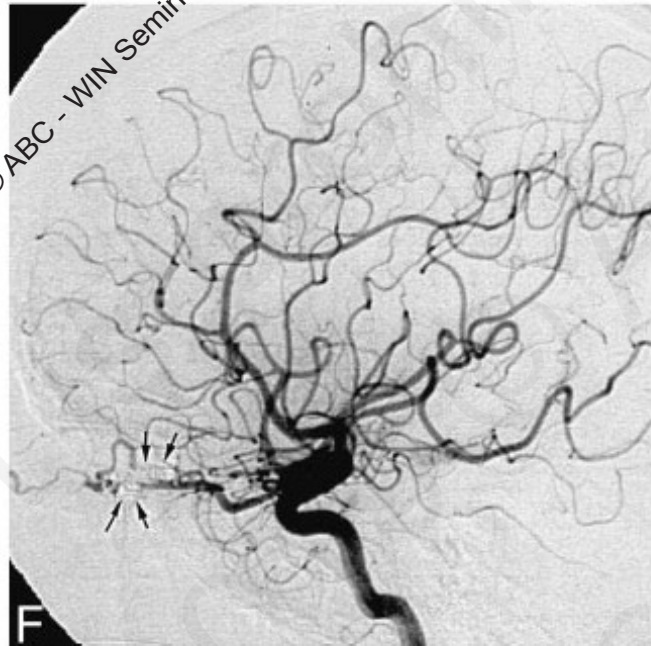
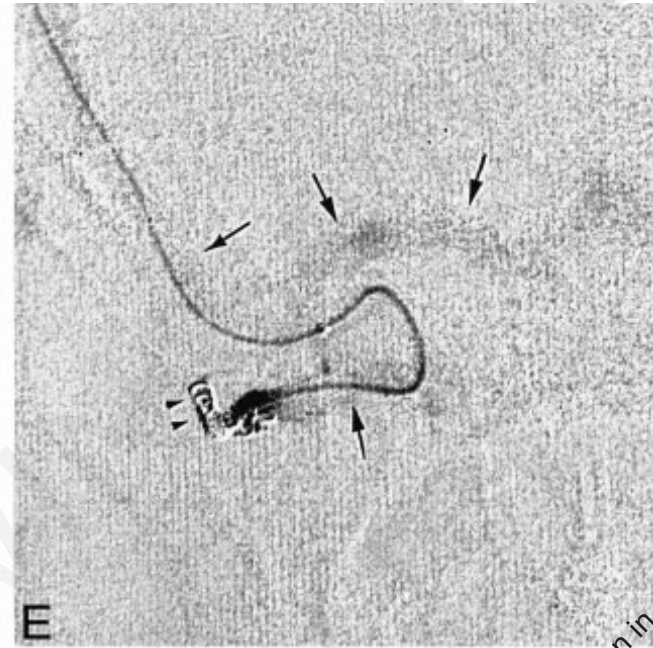
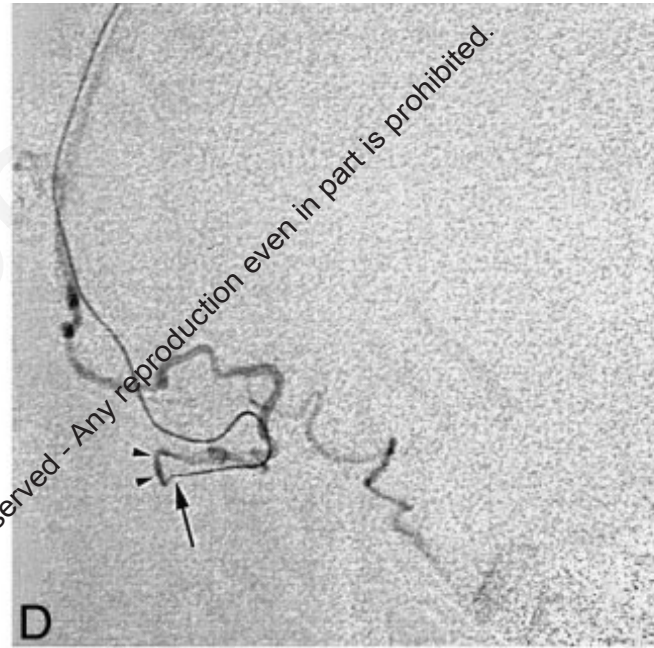
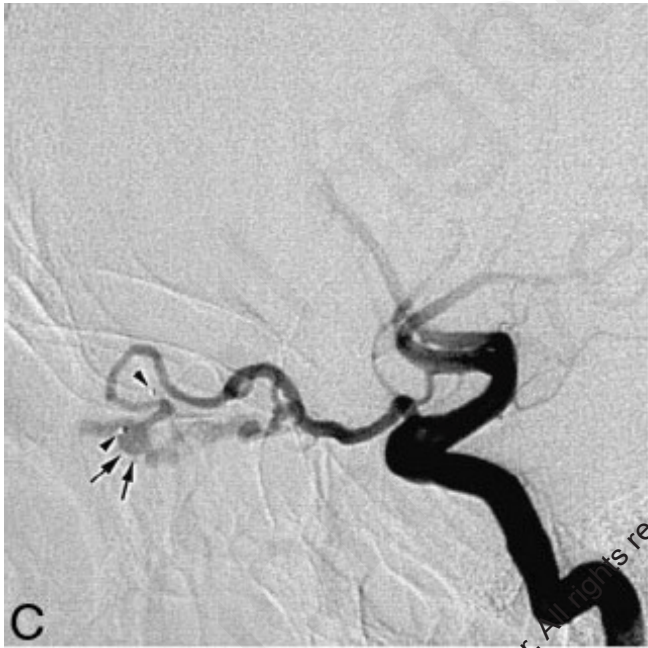
Qiang Li[†], Yi-Bin Fang[†], Qing-Hai Huang, Qi Zhang, Bo Hong, Wen-Yuan Zhao, Jian-Min Liu^{*}, Yi Xu

- 11 cases
- All treated via ophthalmic artery
- 10 complete occlusions, 1 failure
- No loss of vision

Transvenous Embolization of a Dural Arteriovenous Fistula of the Anterior Cranial Fossa: Preliminary Results

Luc Defreyne, Peter Vanlangenhove, Tom Vandekerckhove, Ignace Deschrijver, Guido Sieben, Robert Klaes, and
Marc Kunnen





2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Table 1. Review of the Literature

Series	Patient, Age, Years, Sex	Presentation	Arterial Feeders	Venous Drainage	Transvenous EV Treatment	Complications	Angiographic Outcome	Follow-Up: Result
Defreyne et al., 2000 ¹²	1, 40, M	Subarachnoid hemorrhage, headache	Bilateral anterior ethmoidal arteries; septal branch of sphenopalatine artery	FV-SSS	Coils	—	C.O.	1-month: C.O.
	2, 39, M	Asymptomatic	Bilateral anterior ethmoidal arteries	FV-SSS/BV	Coils	—	C.O.	8-month: C.O.
Lv et al., 2008 ¹³	3, 65, M	Seizure, dementia	Bilateral anterior ethmoidal arteries	FV-SSS	Coils	—	C.O.	6-month: C.O.
	4, 48, M	Visual compromise, headache	Bilateral anterior ethmoidal arteries; septal branch of sphenopalatine artery; middle meningeal artery	FV-SSS	Coils	—	C.O.	3-month: C.O.
Spiotta et al., 2014 ¹⁵	5, 41, M	Headache, dysarthria, left arm apraxia, right eye blurriness	Bilateral anterior ethmoidal arteries	FV-SSS	Onyx-34	—	C.O.	14-month: C.O.
	6, 72, M	Recurrent headache	Bilateral anterior ethmoidal arteries	FV-SSS	Onyx-34	—	C.O.	2-month: C.O.
	7, 55, F	Long history of migraine	Bilateral anterior ethmoidal arteries	FV-SSS/BV	Onyx-34	—	C.O.	6-month: C.O.
Albuquerque et al., 2014 ¹⁴	8, F, age NS	Asymptomatic	Anterior ethmoidal artery	FV-SSS	Onyx-18	—	C.O.	6-month: C.O.
Robert et al., 2016 ¹¹	9, NS	NS	NS	FV-SSS	Onyx + Coils	—	C.O.	9-month (mean): C.O.
	10, NS	NS	NS	FV-SSS	Onyx	—	C.O.	9-month (mean): C.O.
Cannizzaro et al., in press ¹⁶	11, 60, M	Asymptomatic	NS	FV-SSS	Coils	—	C.O.	6–12 month: C.O.
	12, 65, M	Hemorrhage, left paraesthesia	NS	FV-SSS	Coils	—	C.O.	6–12 month: C.O.
Present series	13, 59, F, patient 1	Headache	Bilateral anterior ethmoidal arteries	FV-SSS	Coils	—	C.O.	6- and 12-month: C.O.
	14, 63, F, patient 2	Asymptomatic. Previous temporal hemorrhage from a tentorial DAVF	Bilateral anterior ethmoidal arteries	FV-SSS	Onyx-18	—	C.O.	6-month: C.O.
	15, 50, M, patient 3	Asymptomatic. Previous SAH from a hemorrhagic aneurysm	Bilateral anterior ethmoidal arteries	FV-SSS	Onyx-18	—	C.O.	6-month: C.O.
	16, 70, M, patient 4	Frontal intracerebral hemorrhage	Bilateral anterior ethmoidal arteries; septal branch of sphenopalatine artery	BV	Onyx-18	Asymptomatic intracerebral hemorrhage	C.O.	6-month: C.O.

EV, endovascular; FV, frontal vein; SSS, superior sagittal sinus; C.O., complete occlusion; BV, basal vein; NS, not specified; DAVF, dural arteriovenous fistula.

Transvenous Embolization of Ethmoidal Dural Arteriovenous Fistulas: Case Series and Review of Literature

Limbucci N, Leone G, Nappini S, Rosi A, Renieri L, Consoli A, Pedicelli A, Mangiatto S.

World Neurosurg. 2018 Feb;110:e786-e793.

2019 © ABC - WIN Seminar. All rights reserved. Any reproduction even in part is prohibited.

CHUM series last 15 years

- **13 cases:** 8 men, 5 women, age 41 to 74 mean: 59,9

- **Clinical presentation:**

Fortuitous: 9 (3 aneurysms, 2 other DVF, 1 hypertensive bleed, 1 epistaxis, 1 carotid stenosis, 1 unrelated diplopia)

Hemorrhage: 3

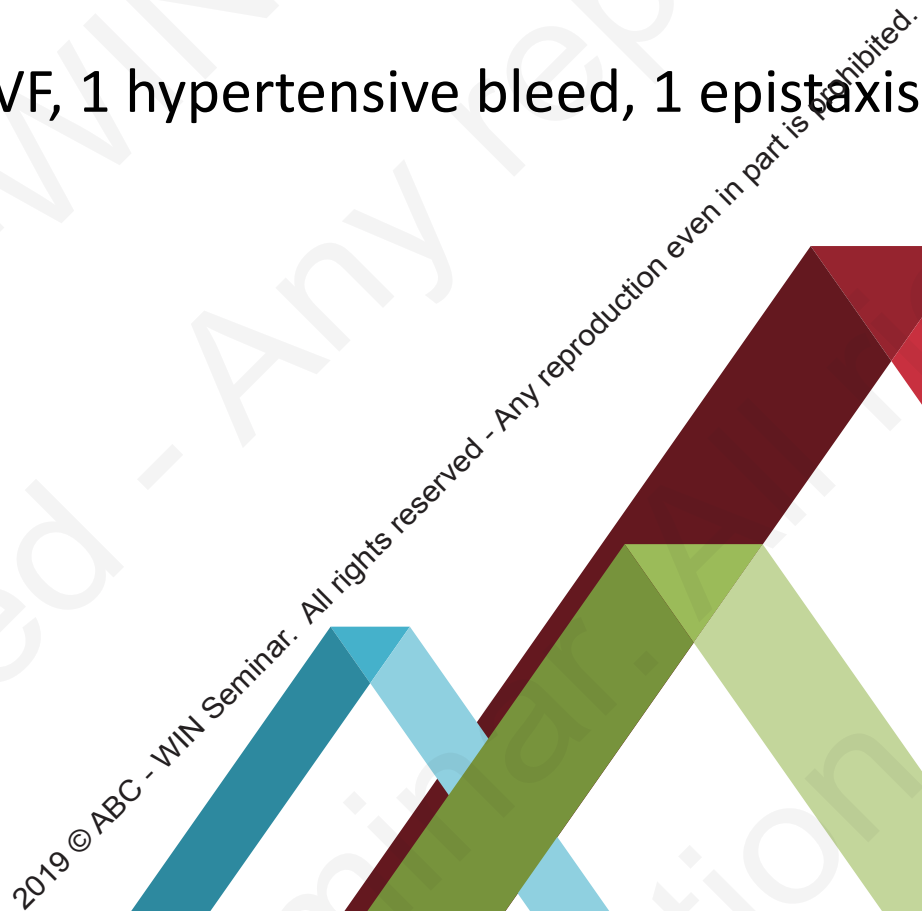
Venous congestion: 1

- **Venous drainage:**

Anterior: 6

Posterior: 4

Both: 3



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

CHUM series last 15 years

- **Management:**

Surgery: 7 (2 after endovascular attempt)

Endovascular: 3

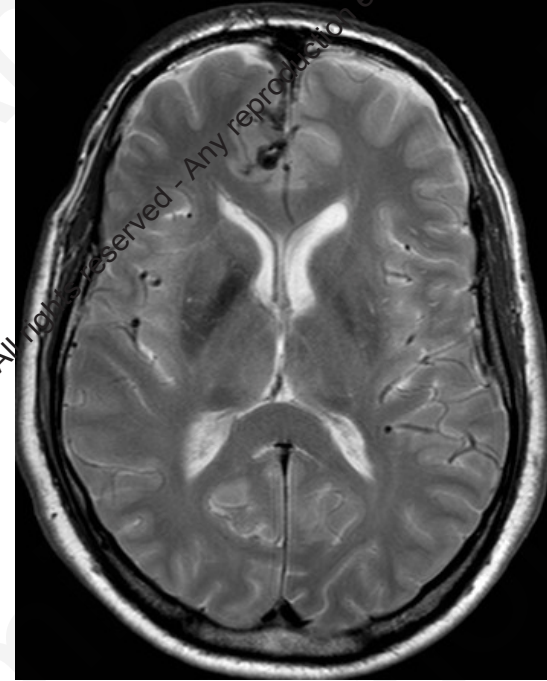
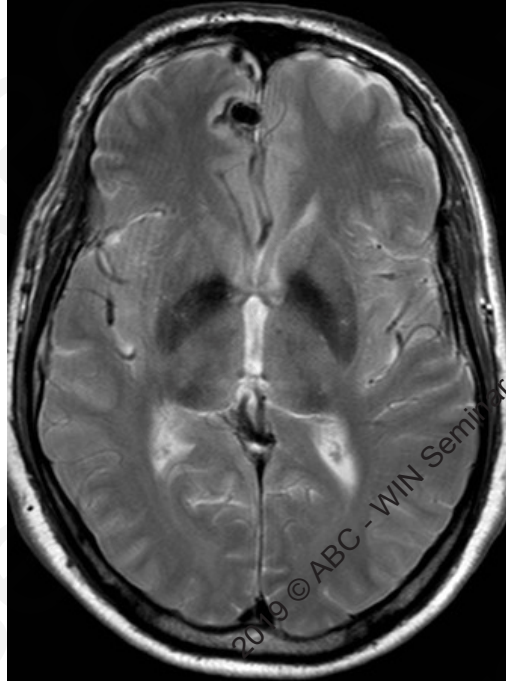
No treatment: 2

Spontaneous thrombosis: 1

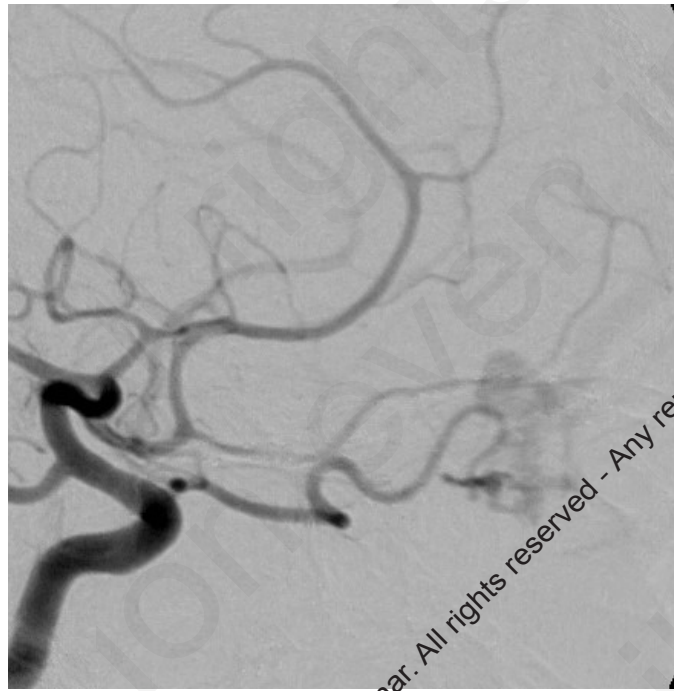
- **Outcome:** Good in all patients



61 year old male
Abrupt headache
No neurological deficit



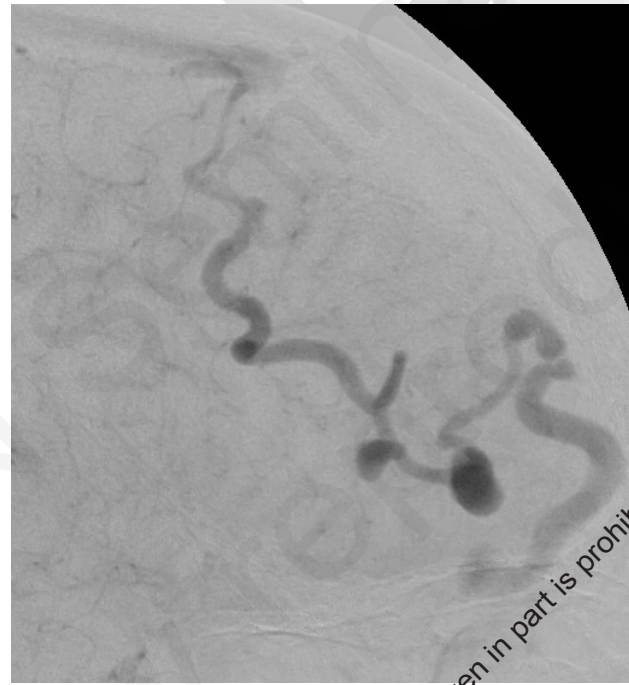
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



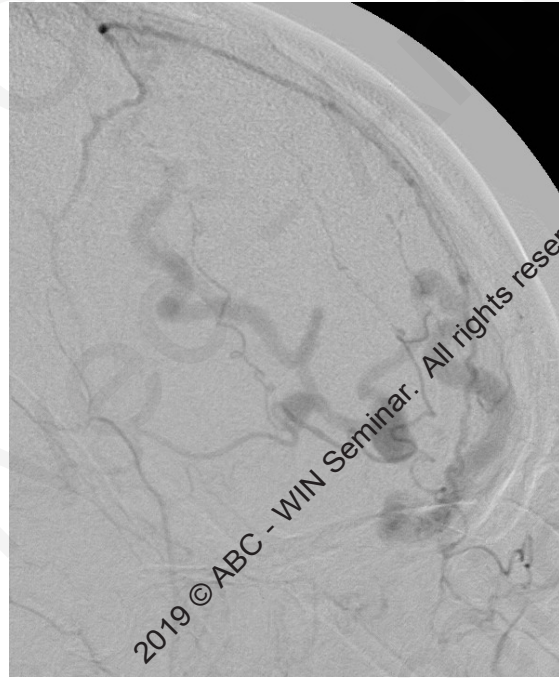
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



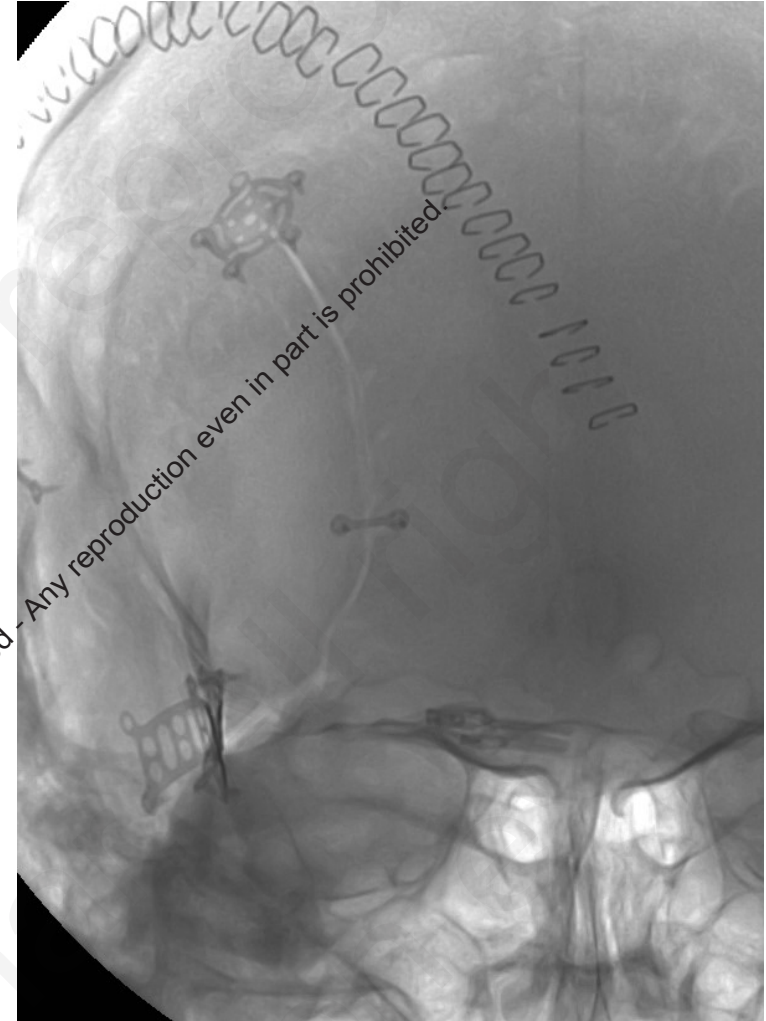
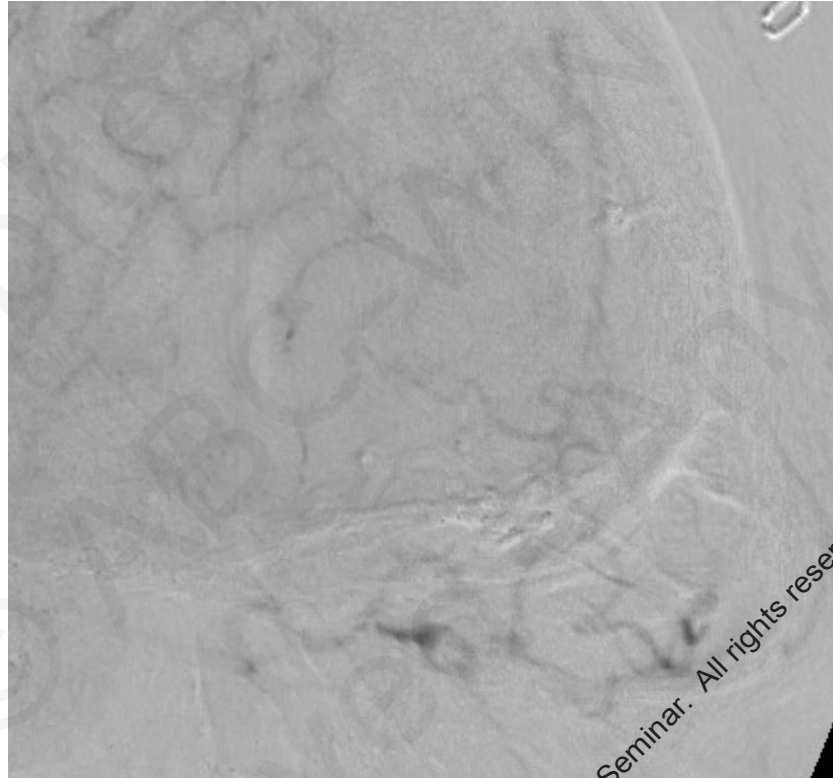
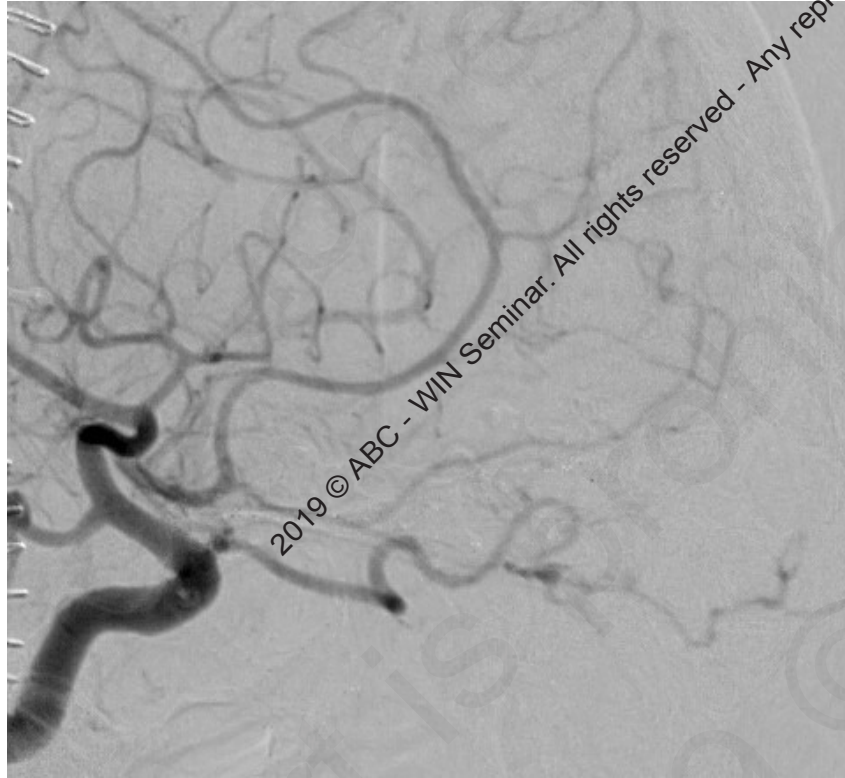
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



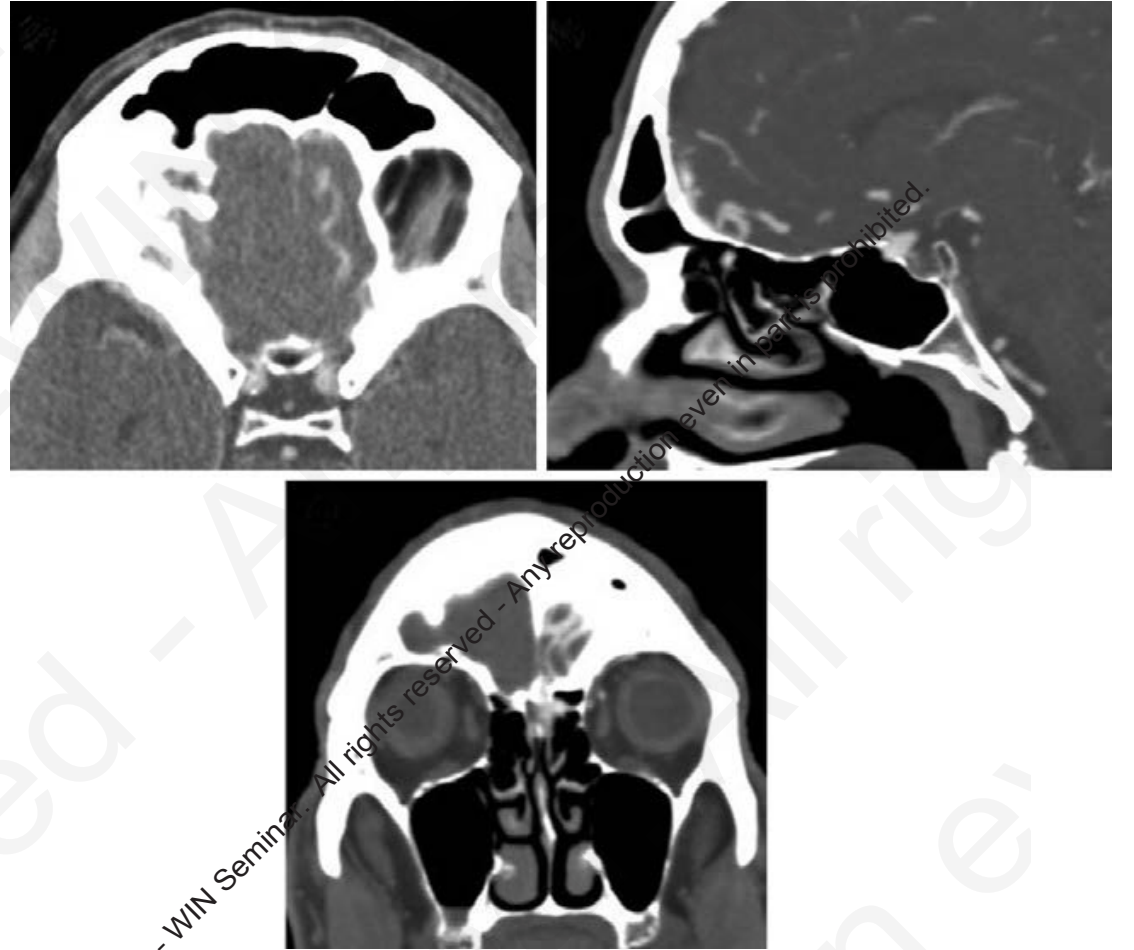
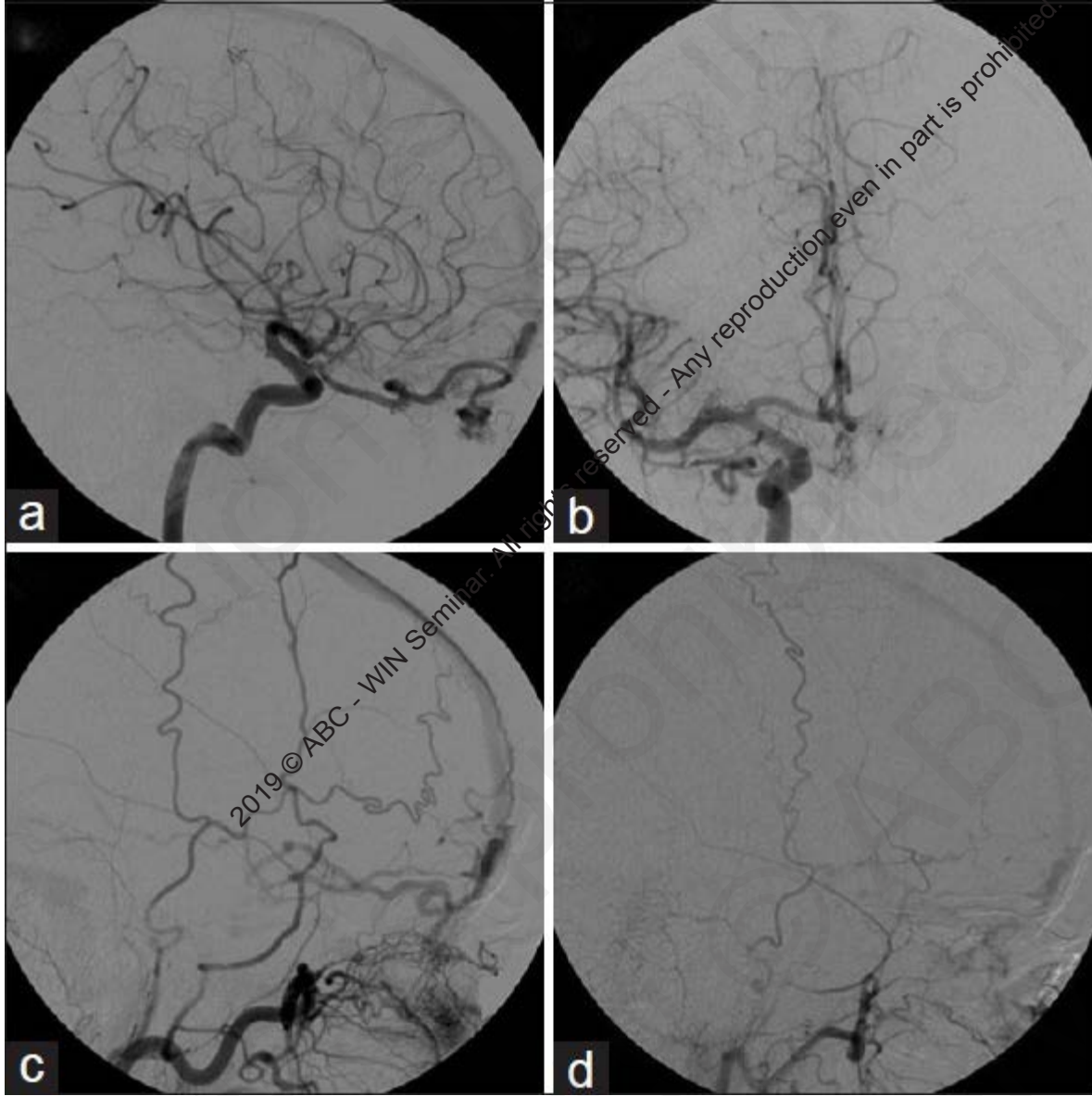
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

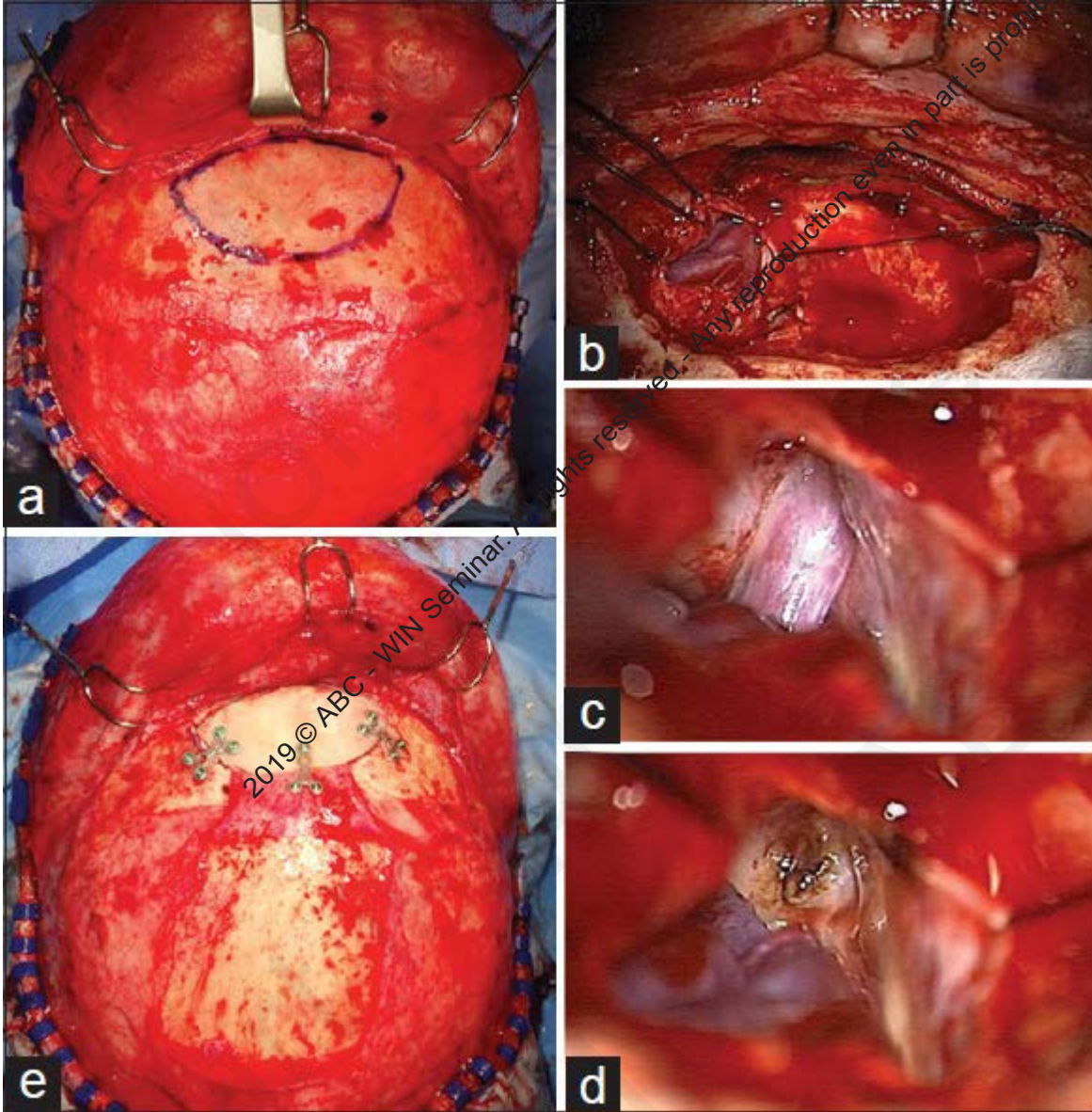
art is h
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Surgery: Orbito-frontal approach



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



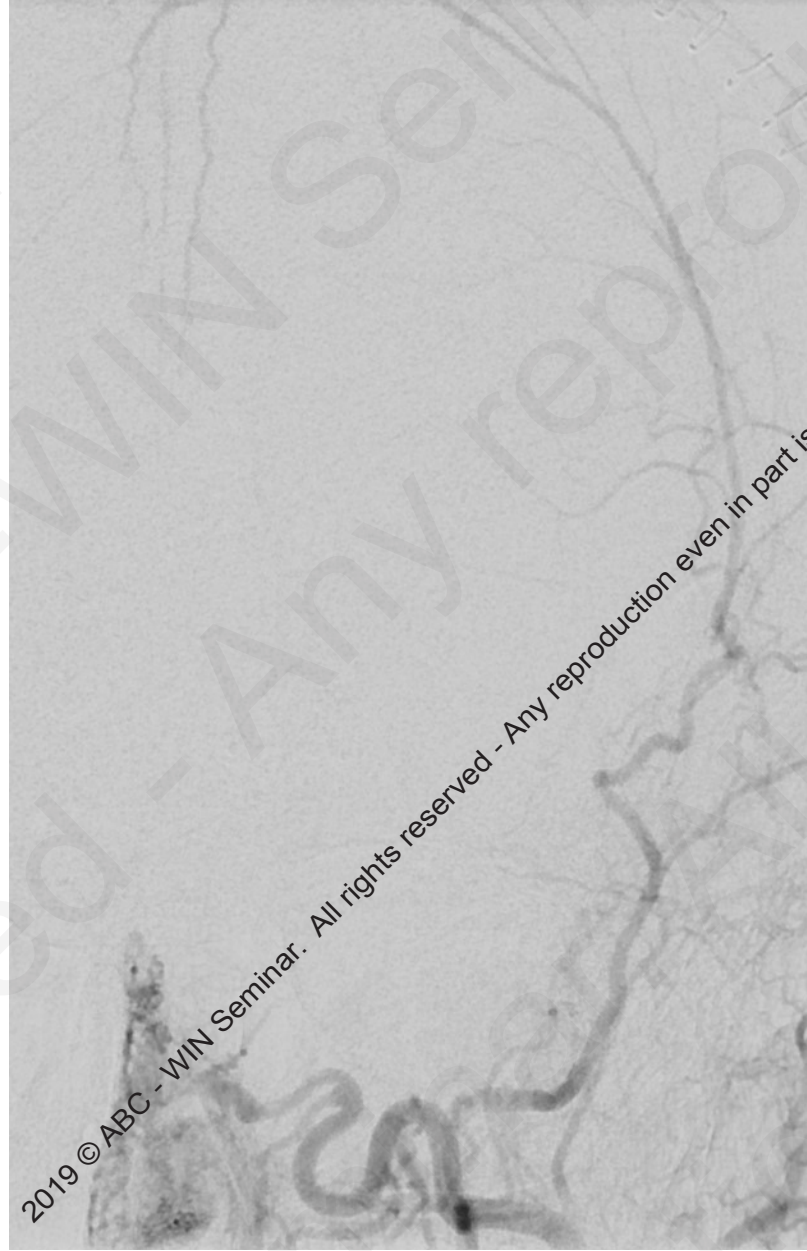
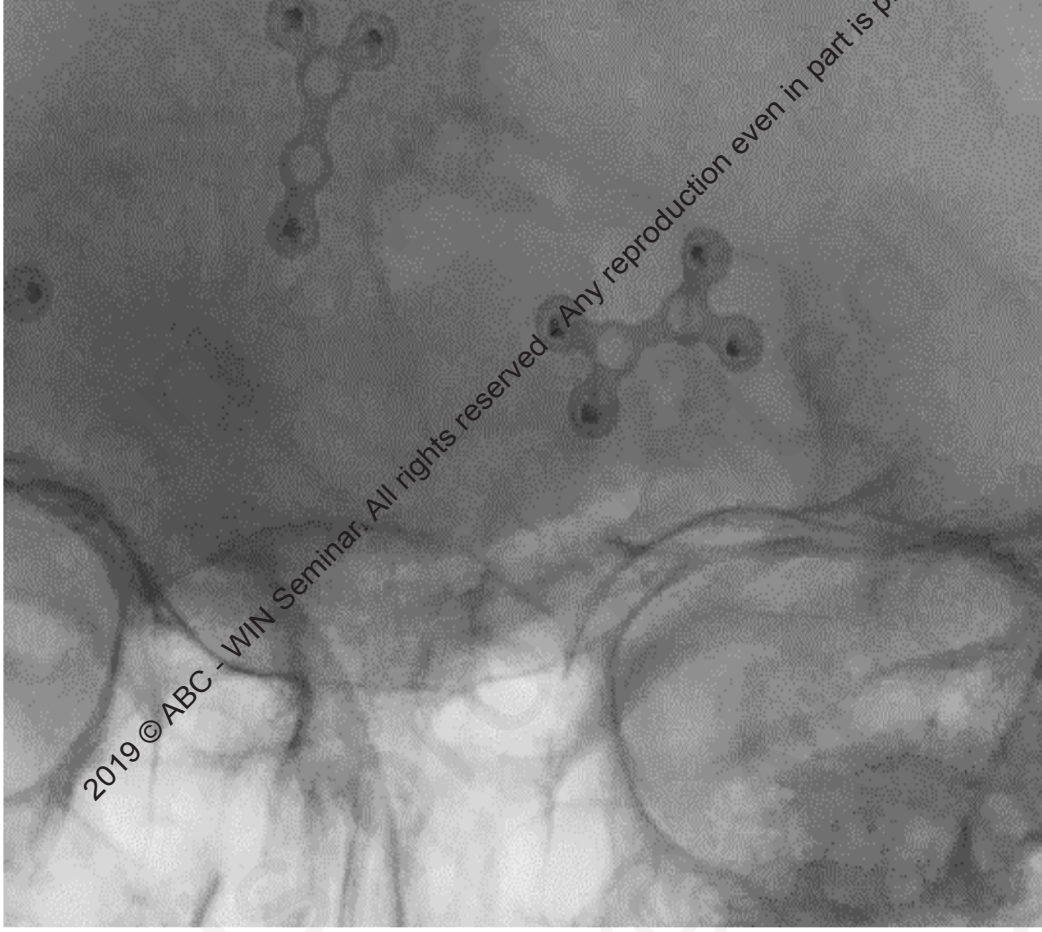


Surg Neurol Int 06-Dec-2014;4:172

Technical Note

Transfrontal sinus approach for an anterior cranial fossa, ethmoidal, and sural arteriovenous fistula

Elsa Magro, Doortje Engel, Michel W. Bojanowski



Visual Field Defect after Transfrontal Sinus Approach of Ethmoidal Dural Arteriovenous Fistulas (eDAVFs) : Experience and Complication of Transfrontal Sinus Approach

Su Yong Choi, Chan Jong Yoo, Jin Yook Kim, Myeong Jin Kim

Department of Neurosurgery, Gachon University Gil Medical Center, Incheon, Korea

J Cerebrovasc Endovasc Neurosurg.
2015 September; 17(3):263-267

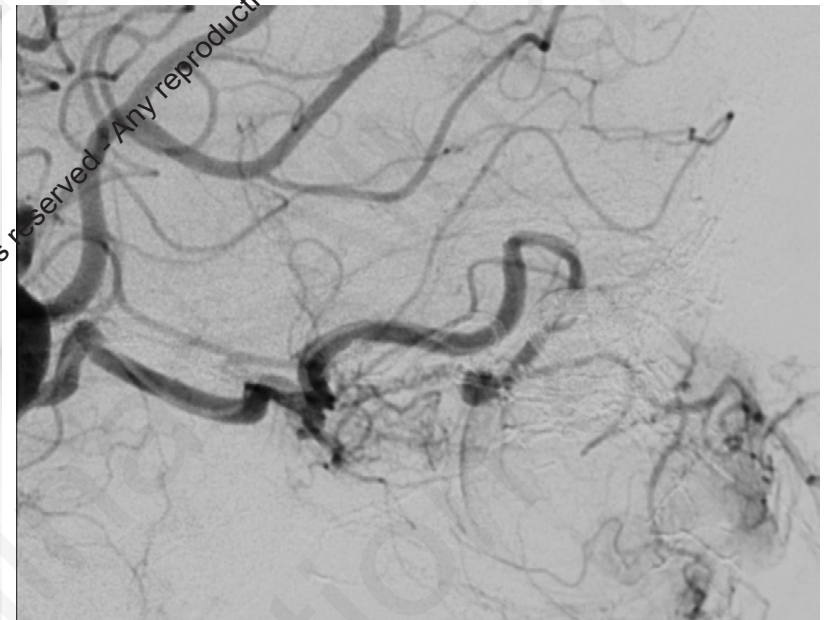
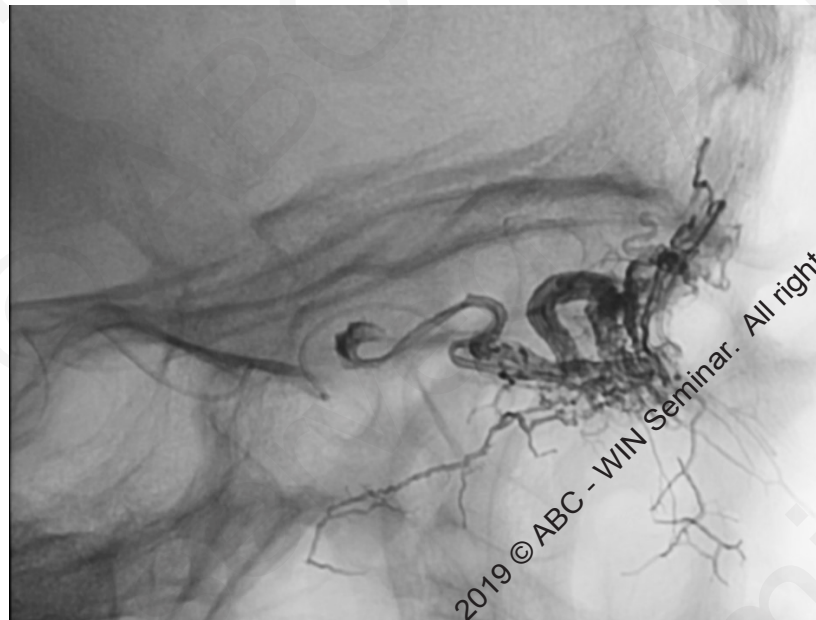
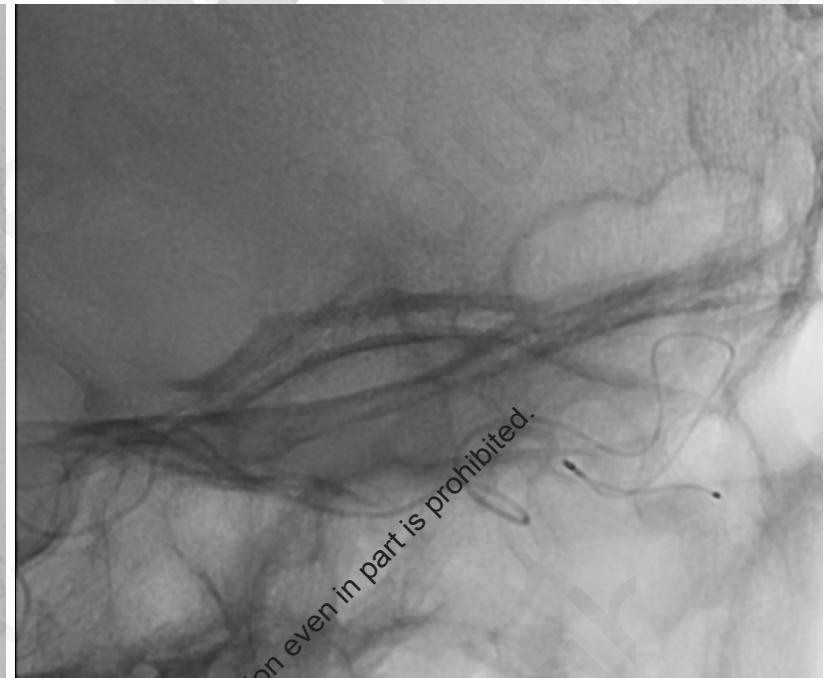
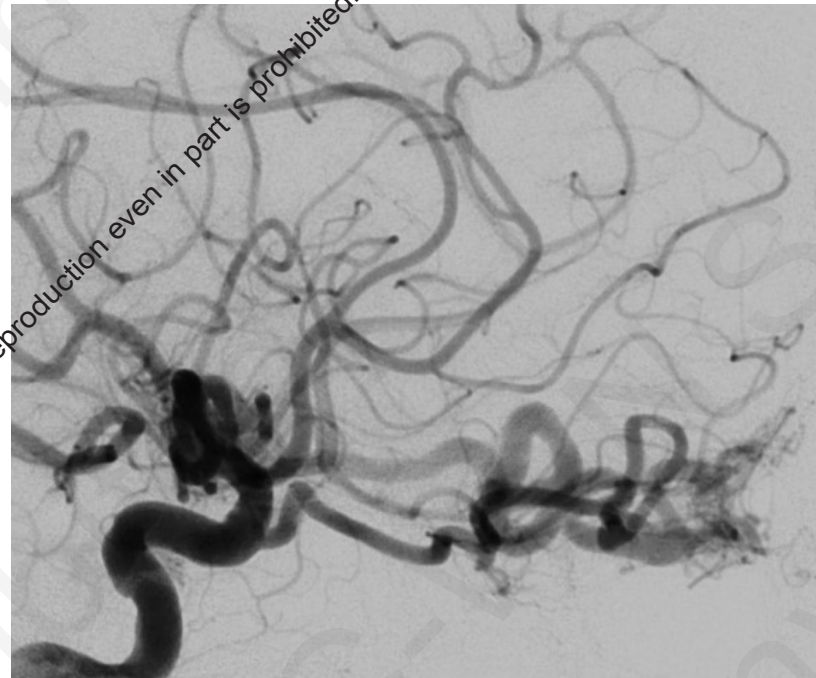


2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

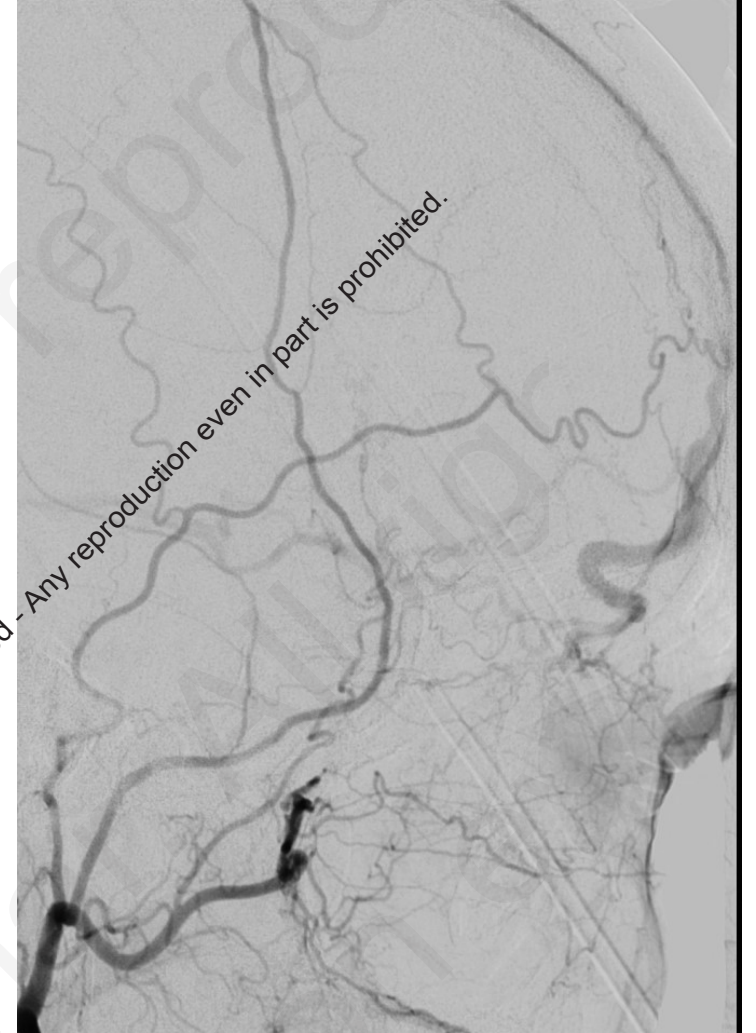
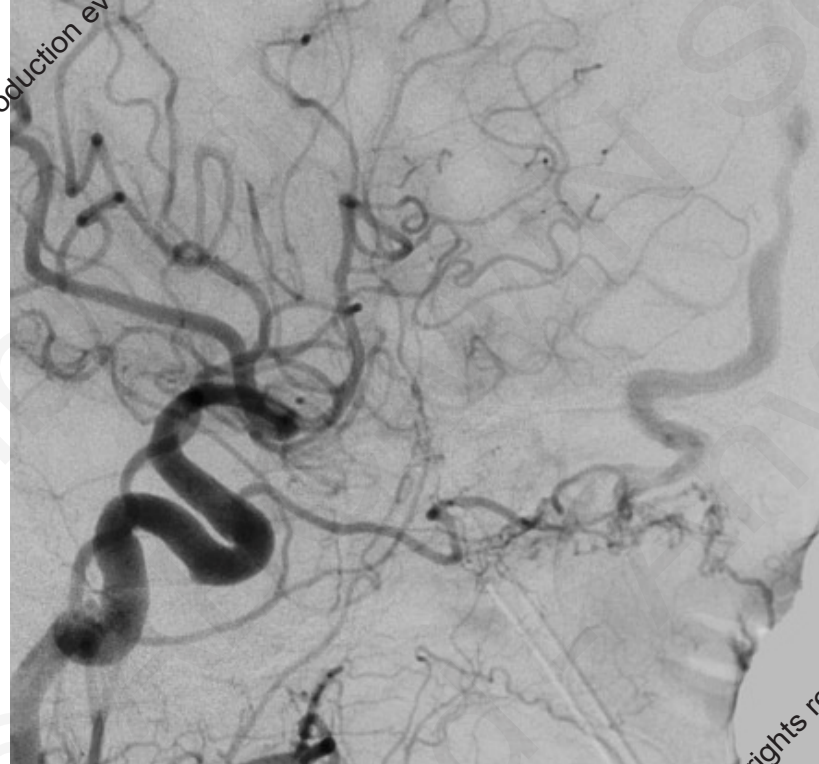
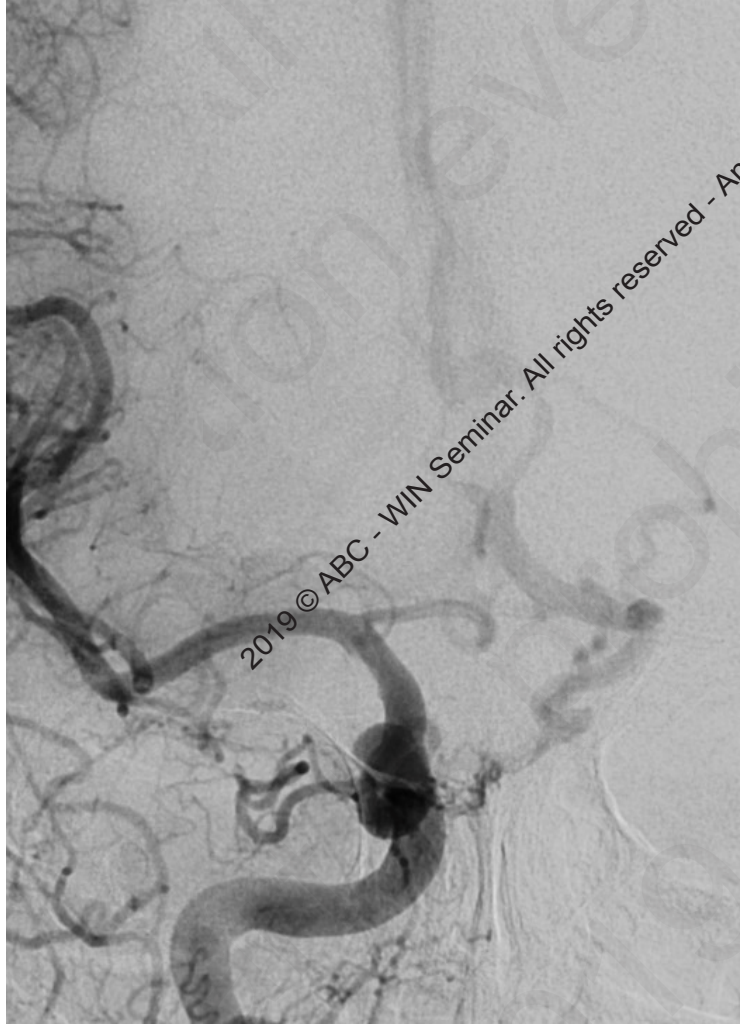
**60 year old female
Fortuitous: RICA
stenosis**

**Endovascular
TA via ophthalmic
artery**

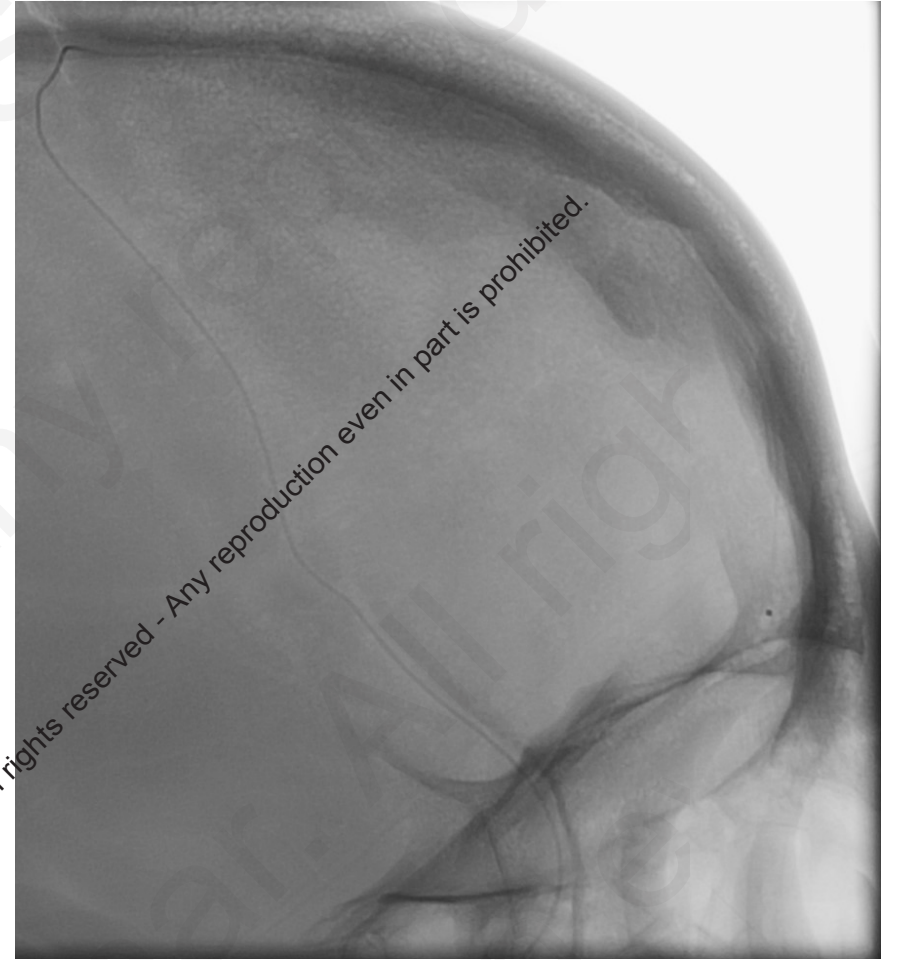
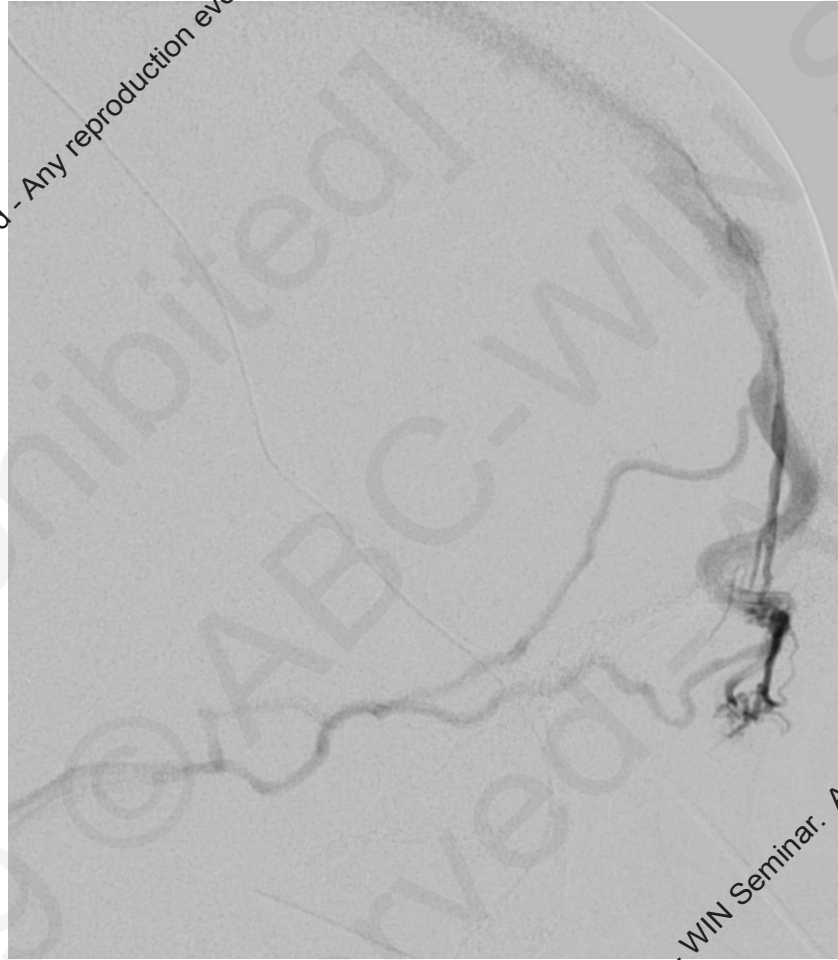
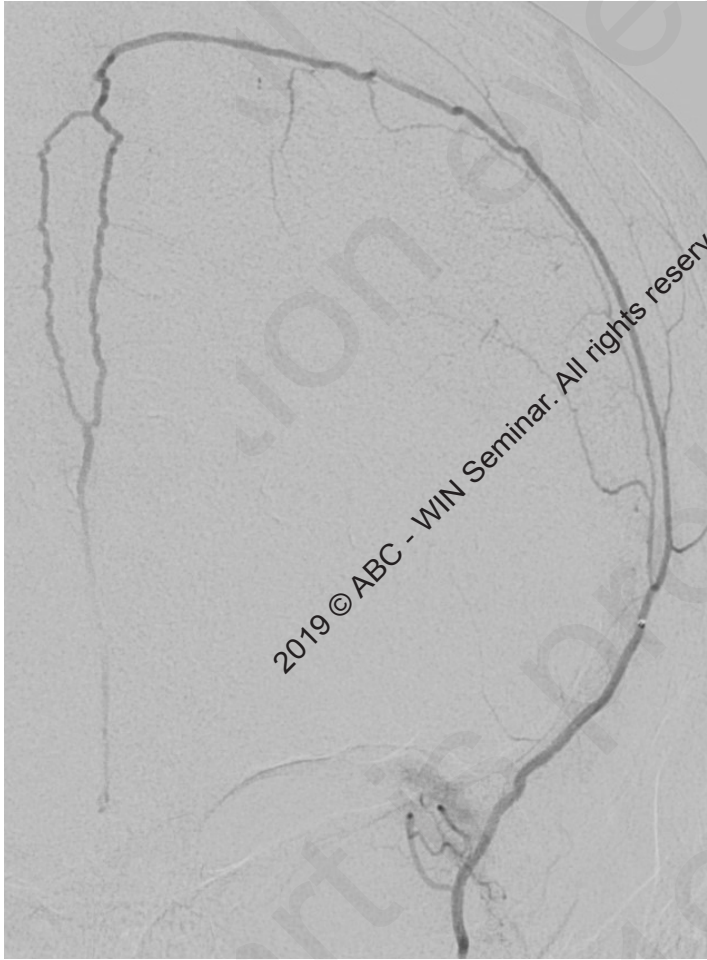


2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

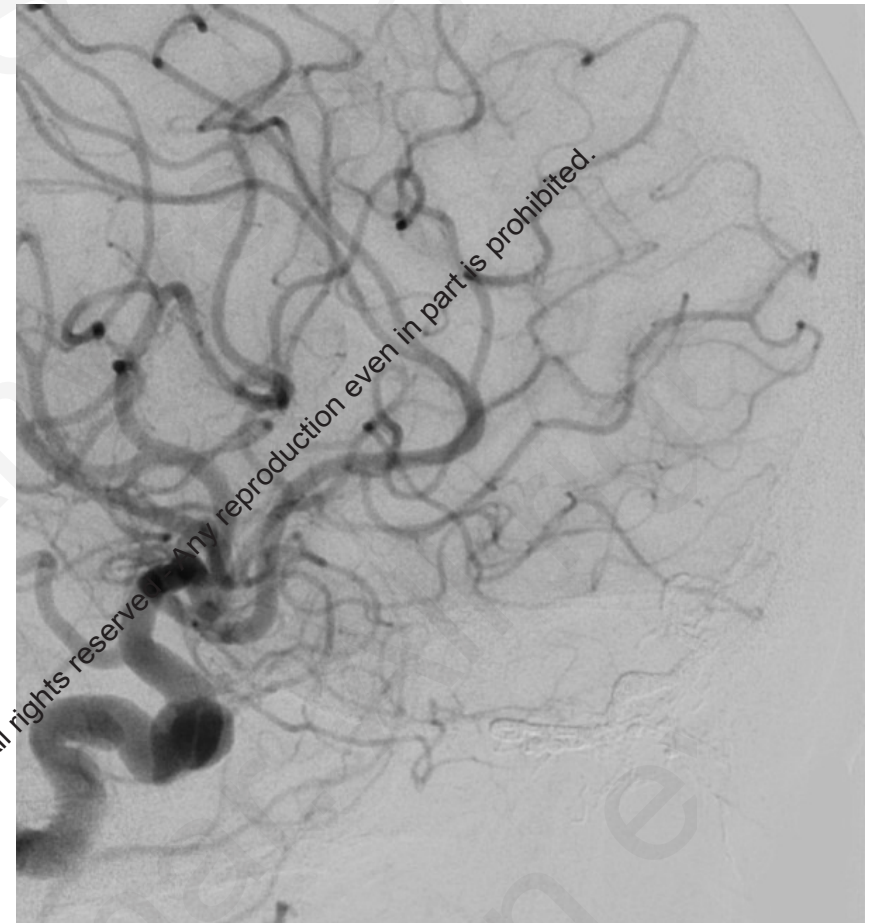
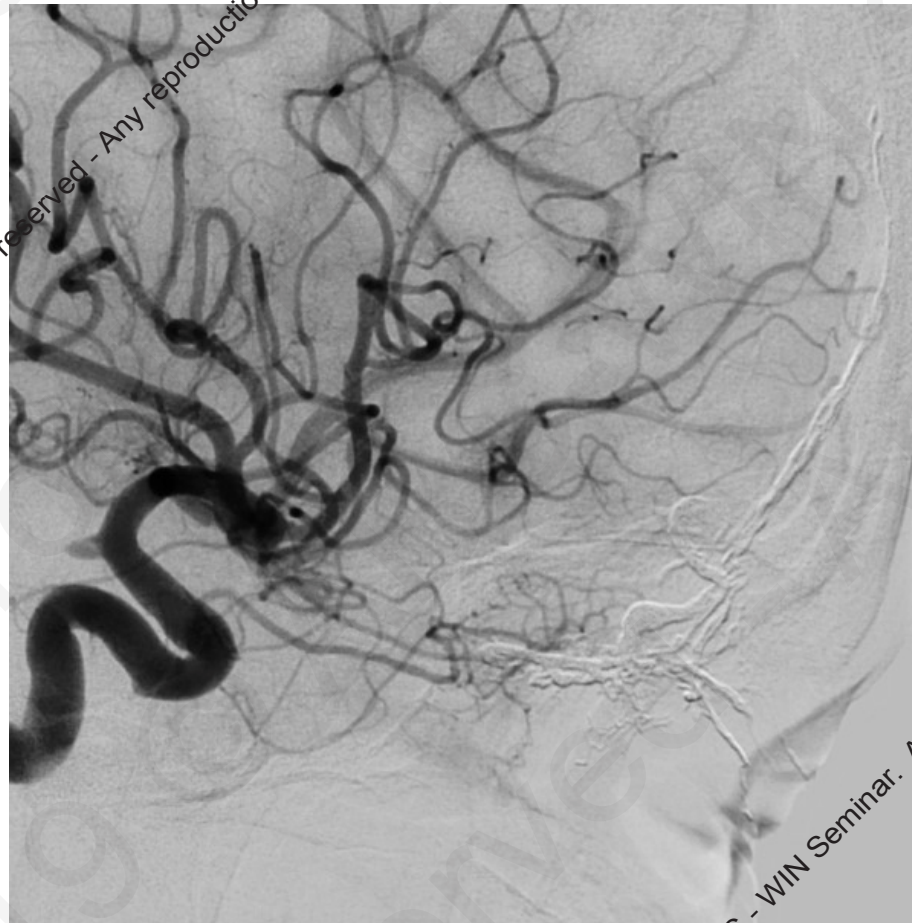
54 year old female: fortuitous discovery



Endovascular: TA via falcine artery



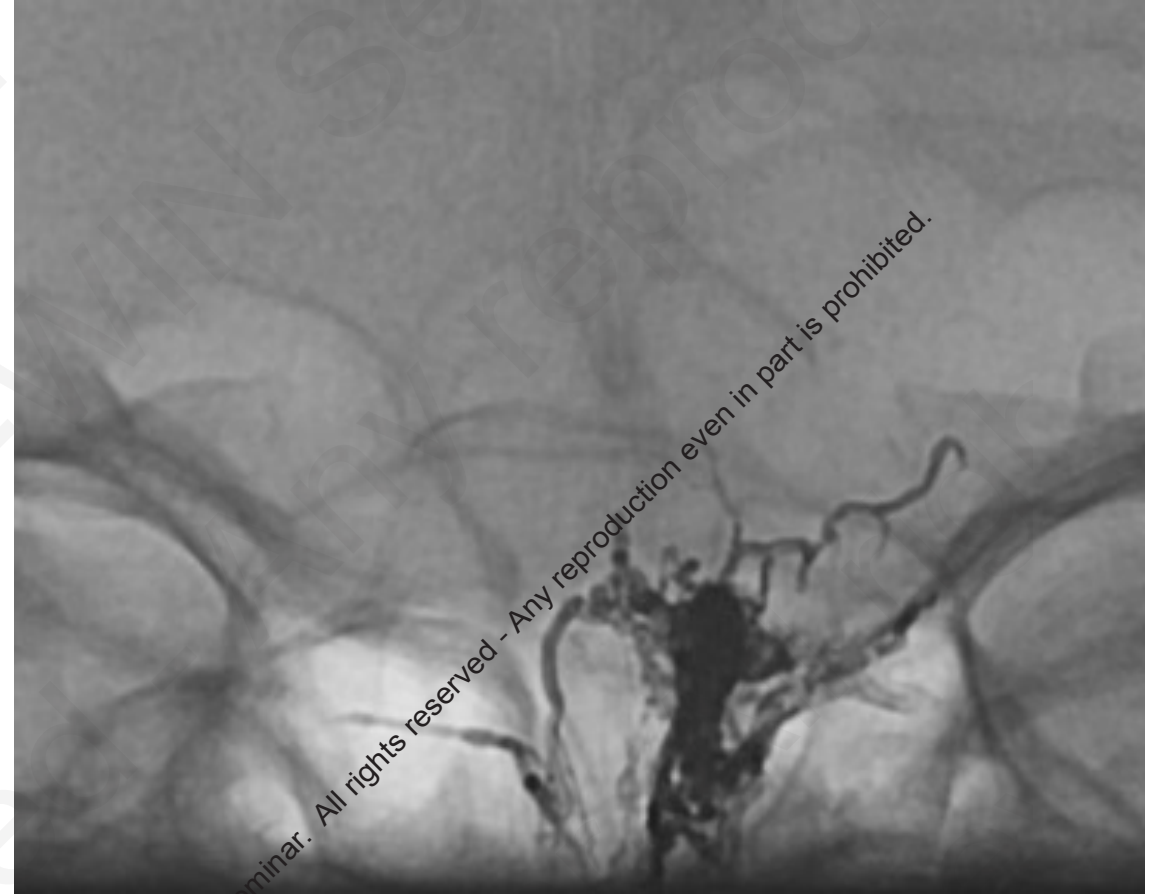
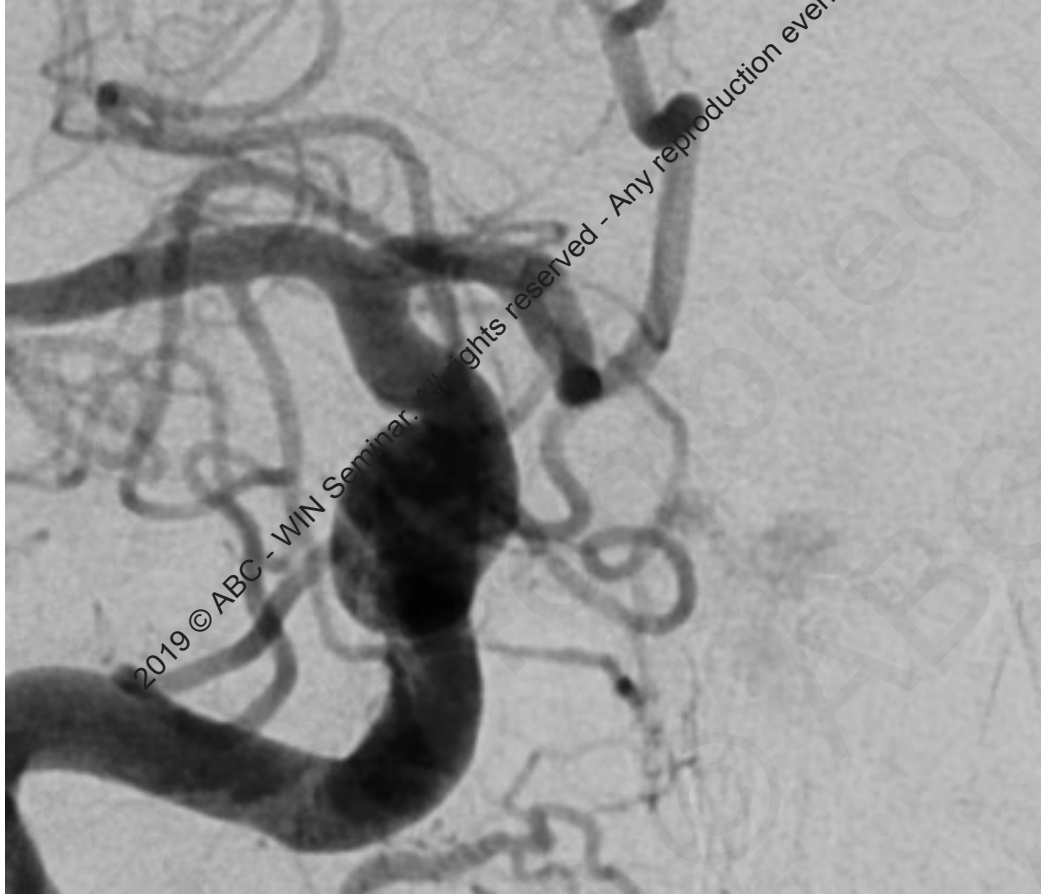
Endovascular: TA via falcine artery



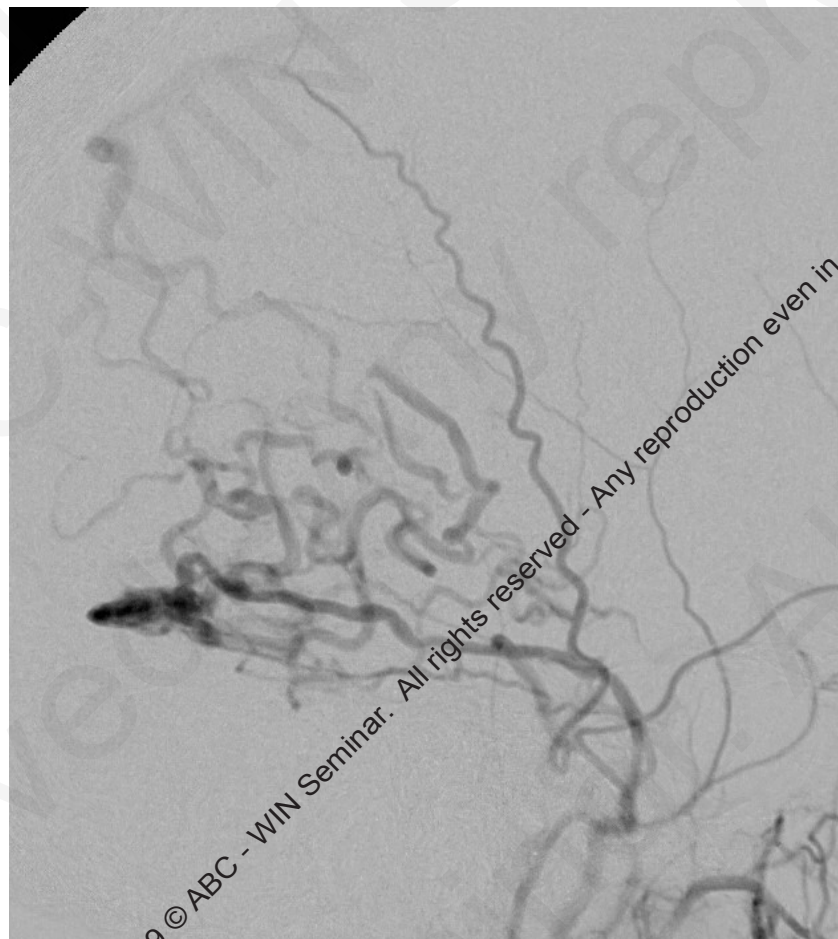
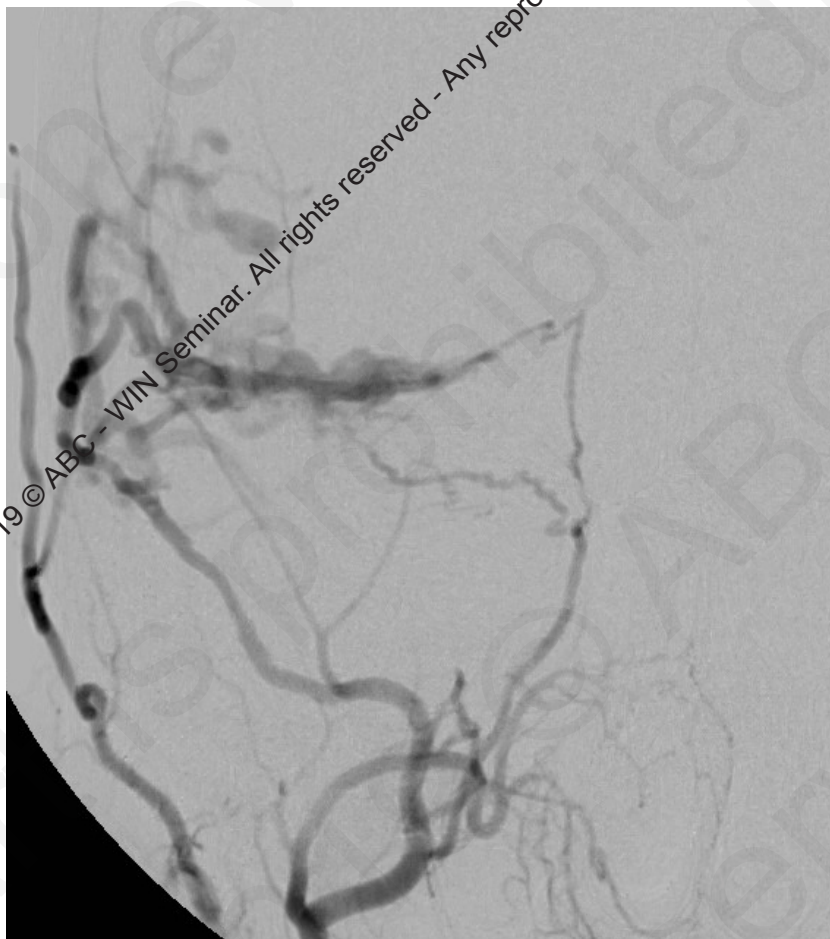
2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

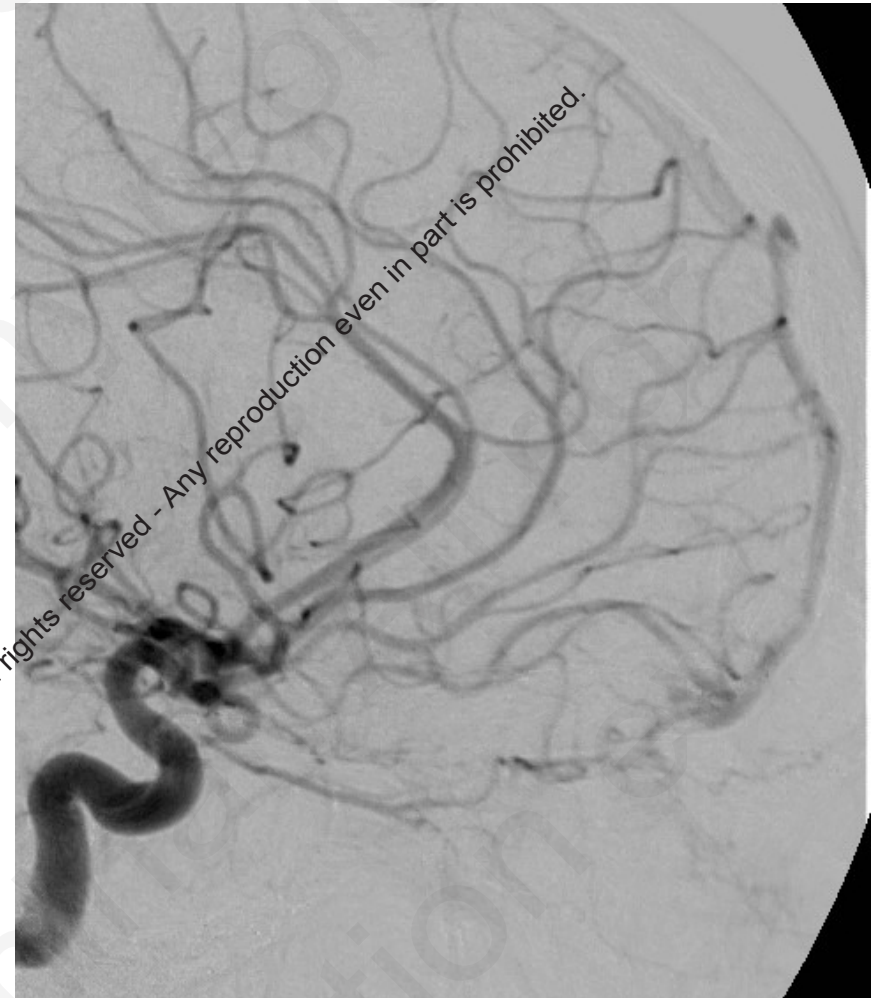
Endovascular: TA via falcine artery



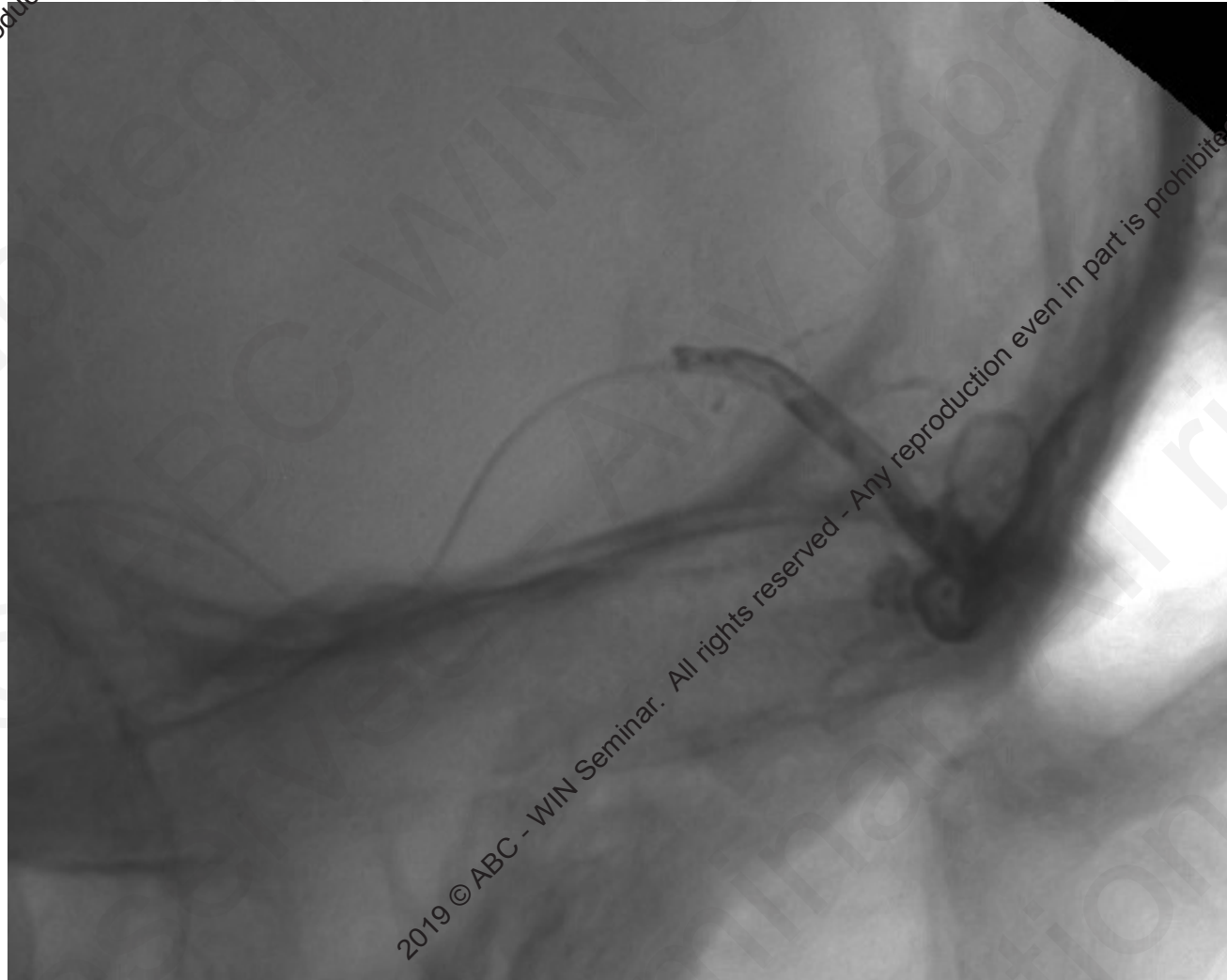
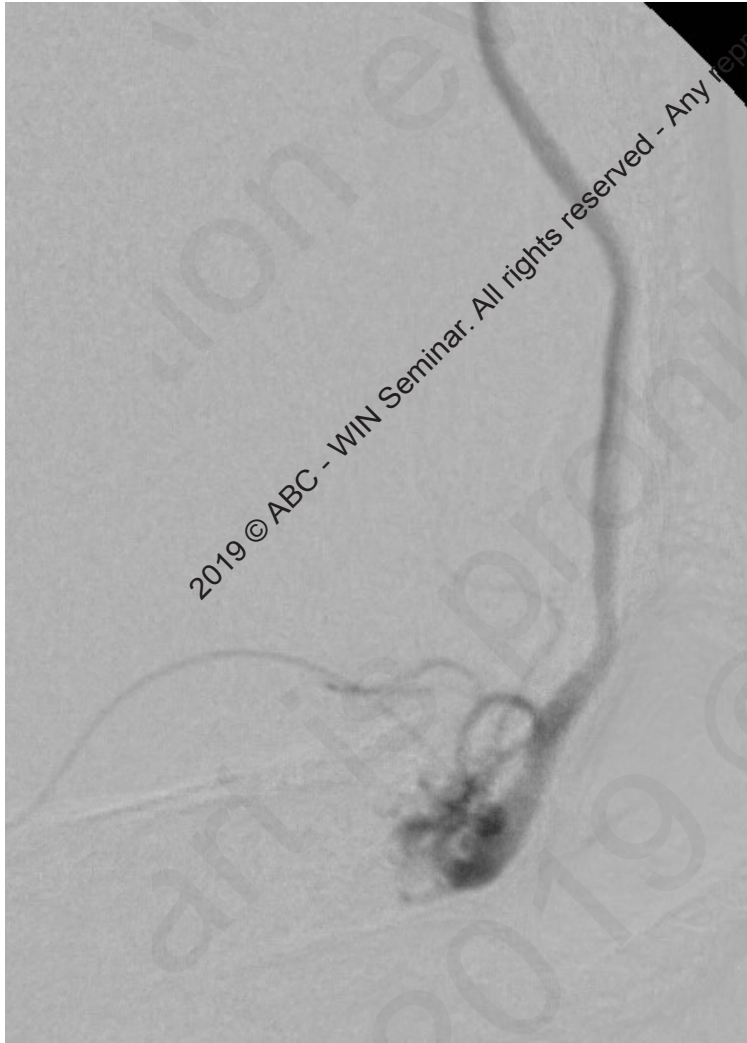
46 year old male: fortuitous, symptomatic right tentorial DAVF



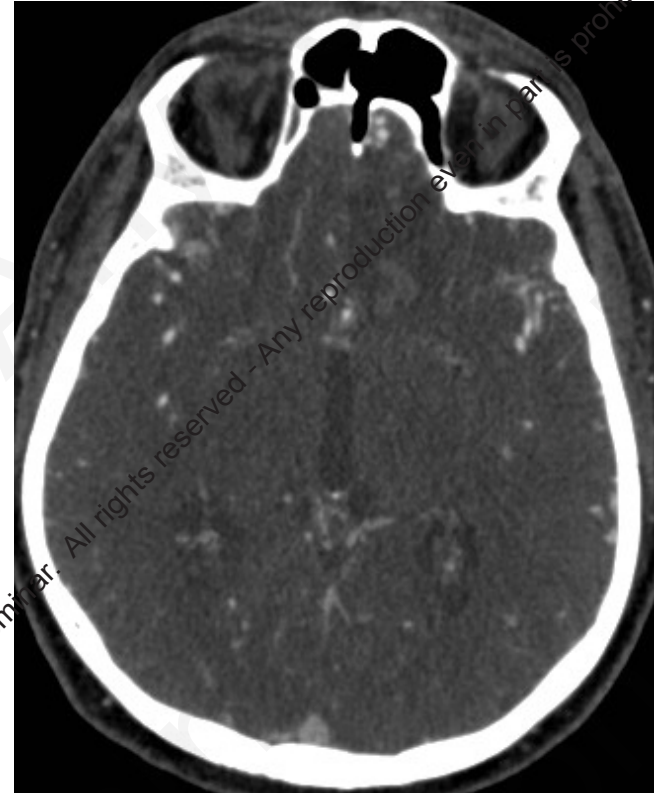
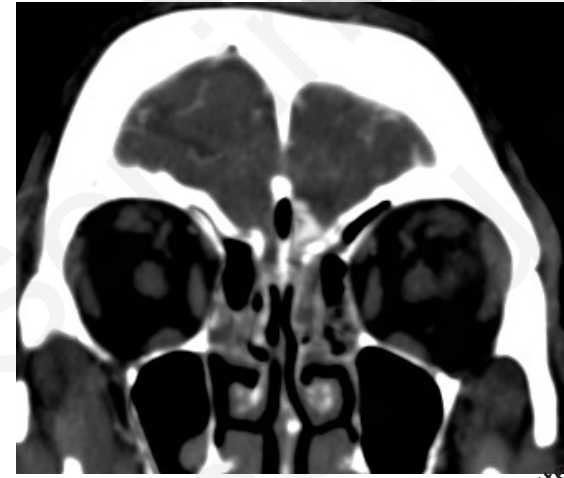
46 year old male: fortuitous, symptomatic right tentorial DAVF



Endovascular: TA via anterior cerebral artery

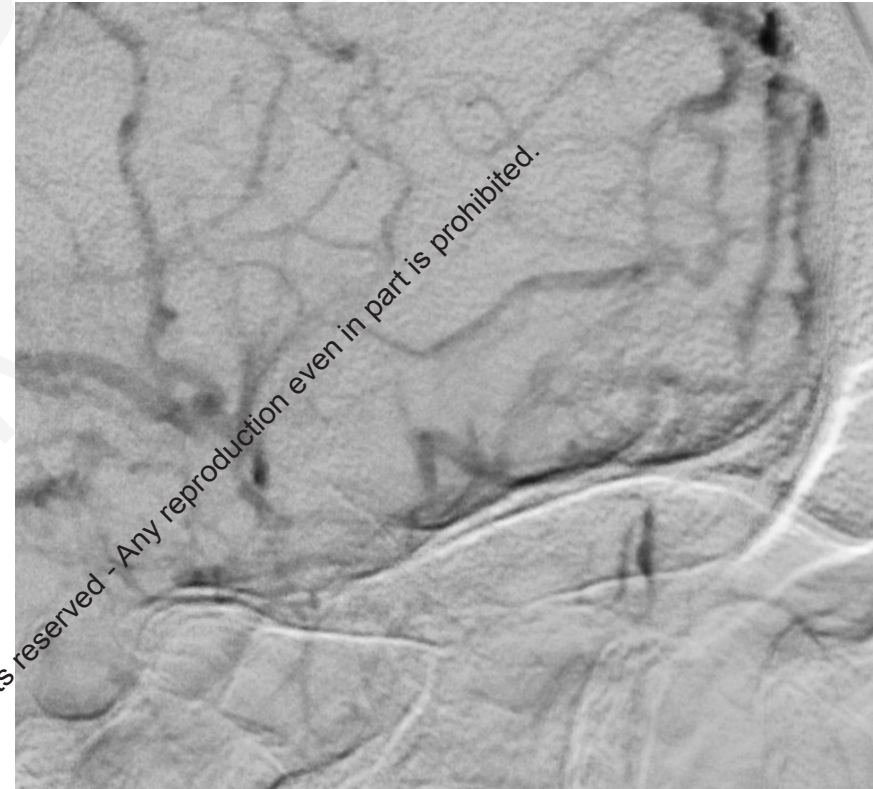
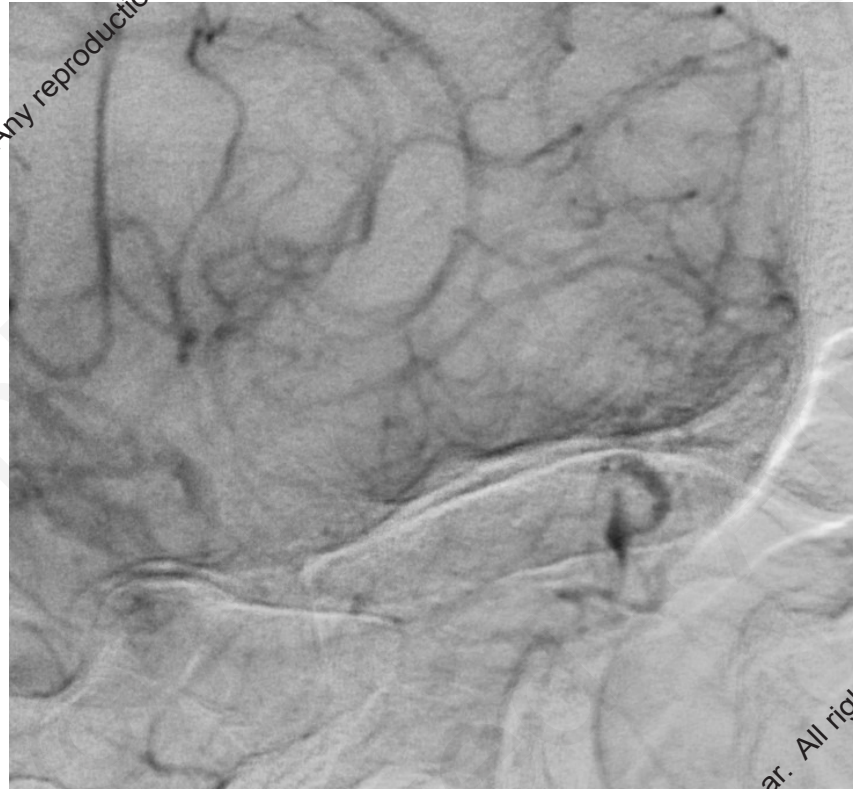


53 year old male Grade 2 SAH



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Spontaneous thrombosis



2019 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Spontaneous thrombosis

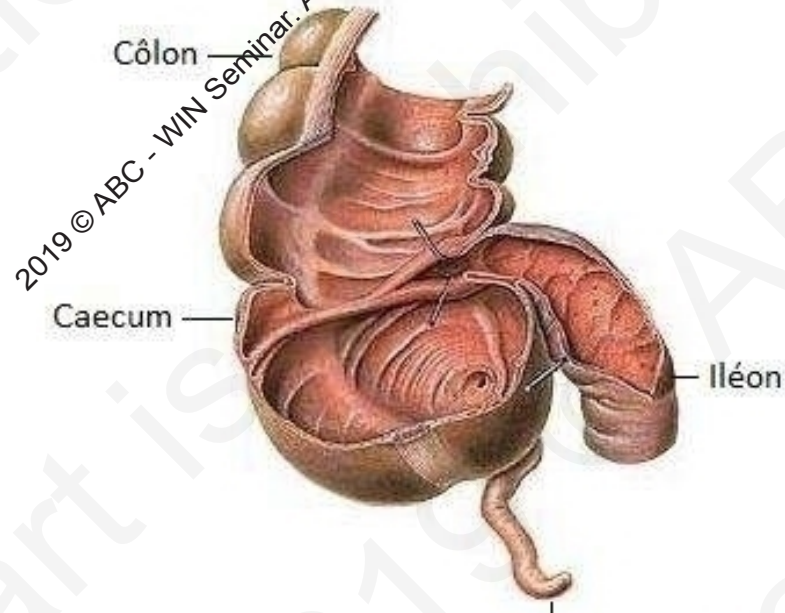


One week later

2019 © ABC - WJW Seminar. All rights reserved - Any reproduction even in part is prohibited.

Conclusions

- Rare disease
- Anatomically related to a persisting vein of the foramen caecum



Caecal fistula?



Conclusions

- All type III or IV lesions (aggressive lesions)
- We will find more and more fortuitous lesions so that the real natural history is largely unknown
- Lesions that had been considered mostly surgical
- Endovascular treatment, either trans-arterial or trans-venous effective in many situations



MERCI!
THANK YOU!

All rights reserved - Any reproduction even in part is prohibited.

All rights reserved - Any reproduction even in part is prohibited.

2019 © ABC - WIN Seminar

2019 © ABC - WIN Seminar