

Dangerous anastomosis of the anterior skull base

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Dangerous anastomosis of the anterior skull base



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Dangerous anastomosis of the anterior skull base



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Dangerous anastomosis of the anterior skull base



□ Anatomical overview

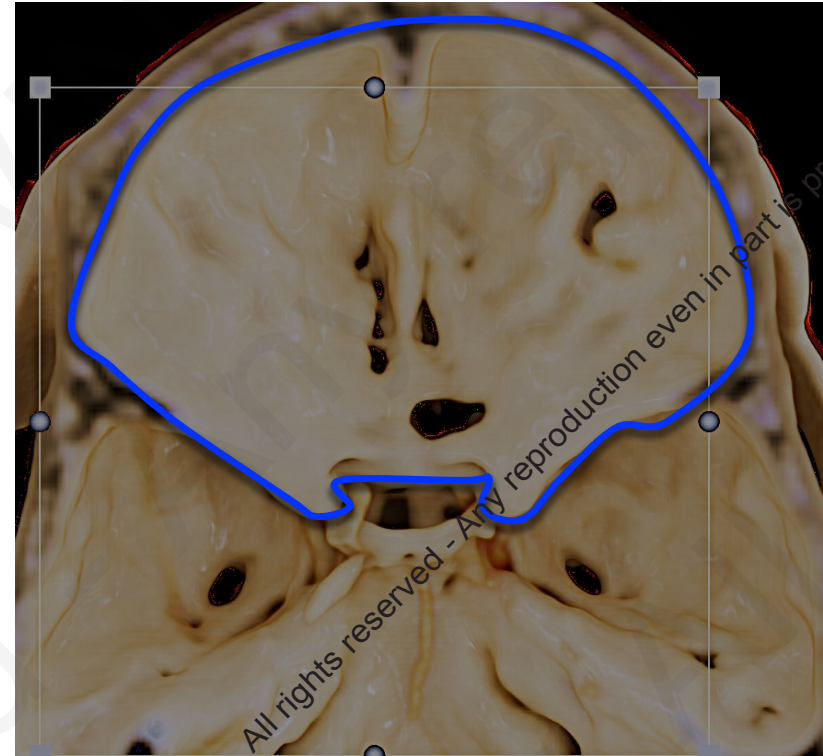
■ Anterior skull base (ASB)

■ Endocranial side

Anterior border: posterior wall of the frontal sinus;

Posterior border: lesser wing of the sphenoid bone and anterior clinoid processes;

Floor: ethmoid and frontal bones (2/3);
planum sphenoidale (1/3)



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Dangerous anastomosis of the anterior skull base



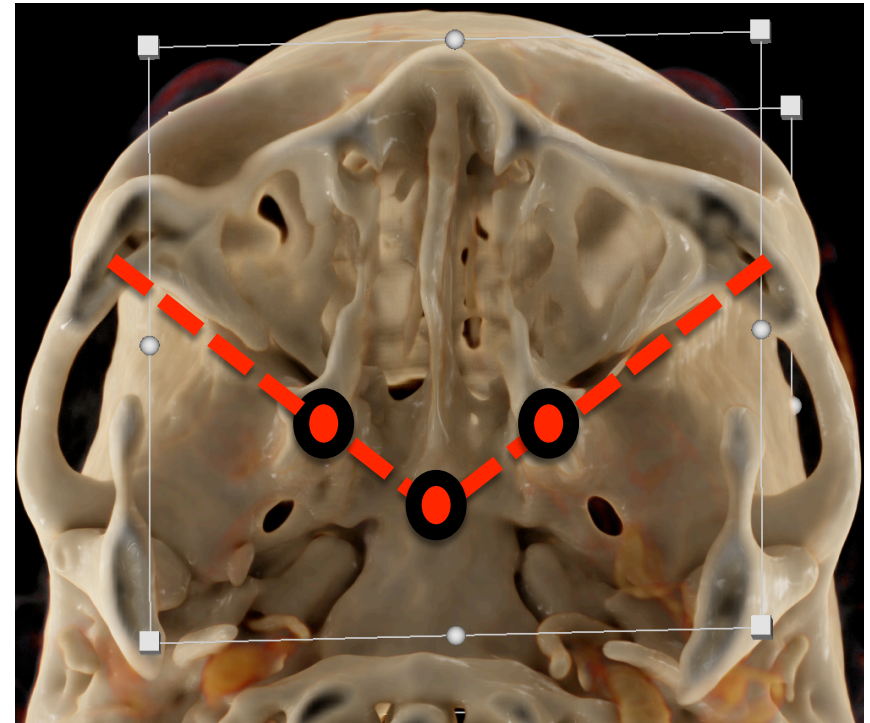
□ Anatomical overview

■ Anterior skull base (ASB)

■ Exocranial side

posterior border → transverse line through the:

- pterygomaxillary fissure,
- pterygopalatine fossae,
- vomer attachment to the sphenoid



Dangerous anastomosis of the anterior skull base

□ Nasopharynx

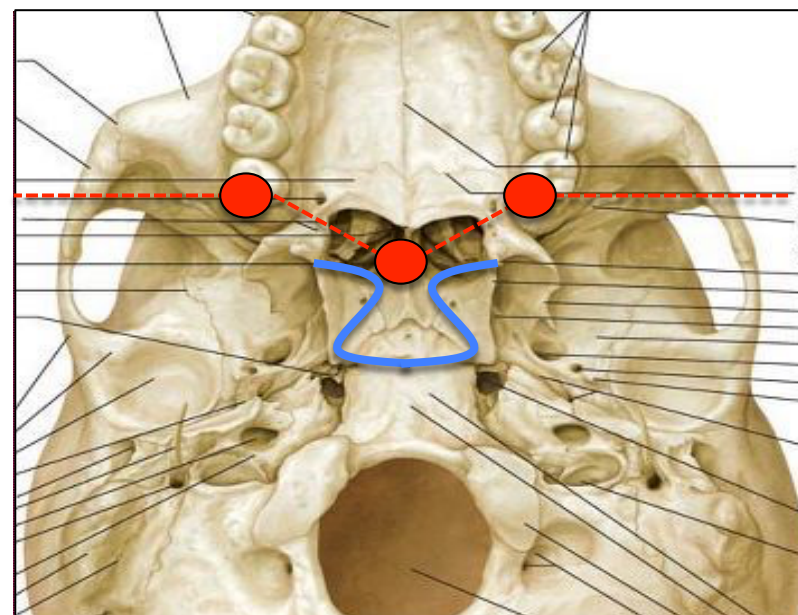
- Eustachian tube arterial anastomotic system

□ ICA:

- Mandibular artery

□ ECA:

- Ascending Pharyngeal artery (superior pharyngeal branches)
- Internal Maxillary artery
 - Accessory meningeal artery (foramen ovale)
 - Pterigovaginal artery
 - Vidian artery



Dangerous anastomosis of the anterior skull base

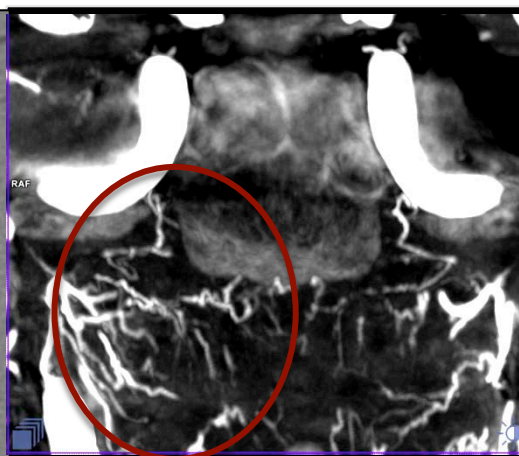
Exocranial

Eustachian tube
anastomotic area

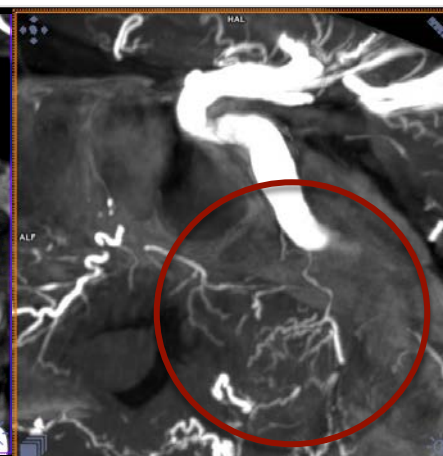
AccM art ↔ Asc Ph art (superior pharyngeal br)
↔ IMAX art (vidian and pterigovaginal art)
↔ ICA (mandibular art)



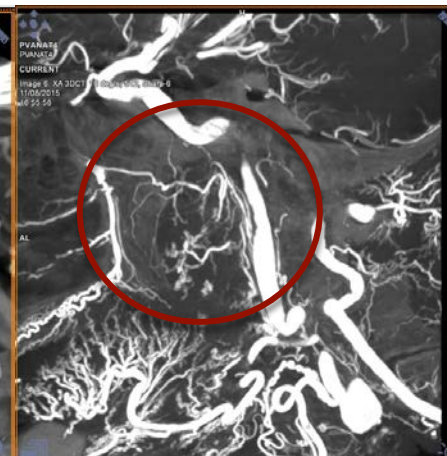
ICA Mandibular artery
(JAF case)



Anastomosis
ICA Mandibular artery
Asc Ph art (superior phar br)



Anastomosis
ICA Mandibular art
Asc Ph art (sup phar br)



Anastomosis
Pterigovaginal artery
ICA / AscPH A

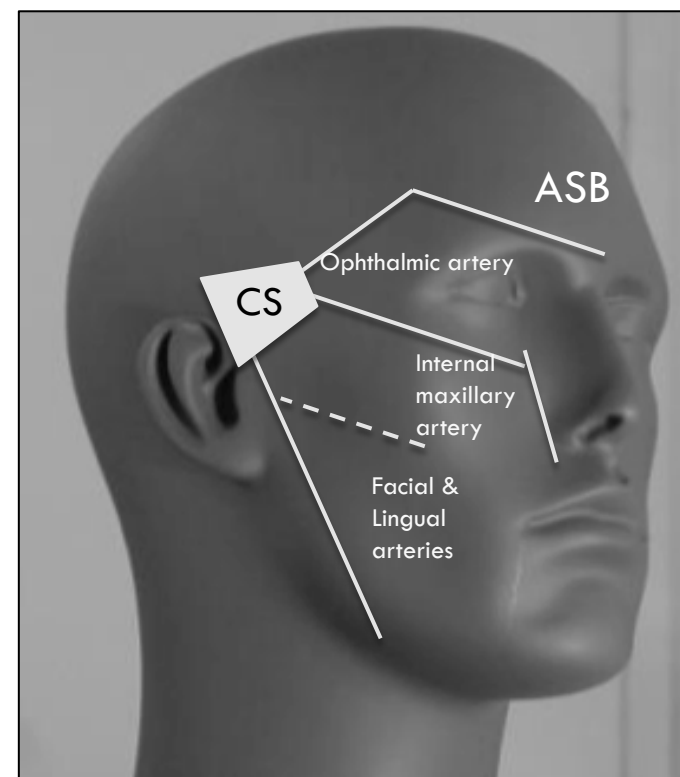
Dangerous anastomosis of the anterior skull base

■ Anatomical overview

■ Major anastomotic areas

(collateral circulation – hemodynamic balance)

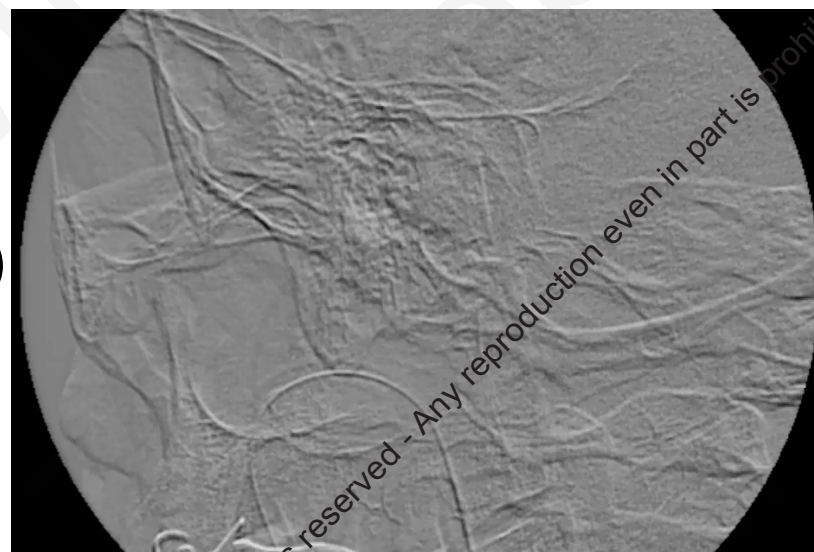
- Nasal fossa (paranasal sinuses)
- Orbital
- Anterior skull base





Dangerous anastomosis of the anterior skull base

- Anatomical overview
 - Major anastomotic areas
(collateral circulation)
 - Nasal fossa (paranasal sinuses)
 - Orbital
 - Anterior skull base



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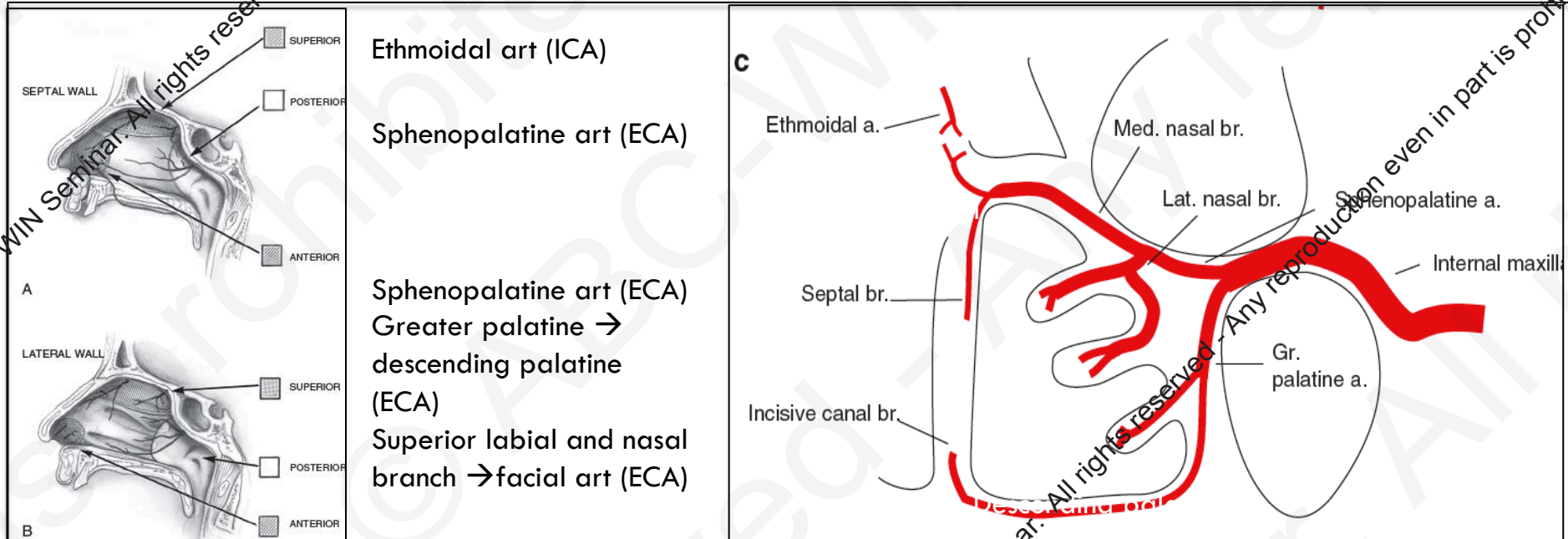
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Nasal fossa

- Ophthalmic artery (Ethmoidal arts) – Internal maxillary artery (Sphenopalatine art)



From: Demo MM in Current Therapy in Oral and Maxillofacial Surgery (2012)

From: Byrne J in Textbook in Endovascular Neurosurgery and Interventional Neuroradiology (2017)

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Dangerous anastomosis of the anterior skull base

■ Nasal fossa

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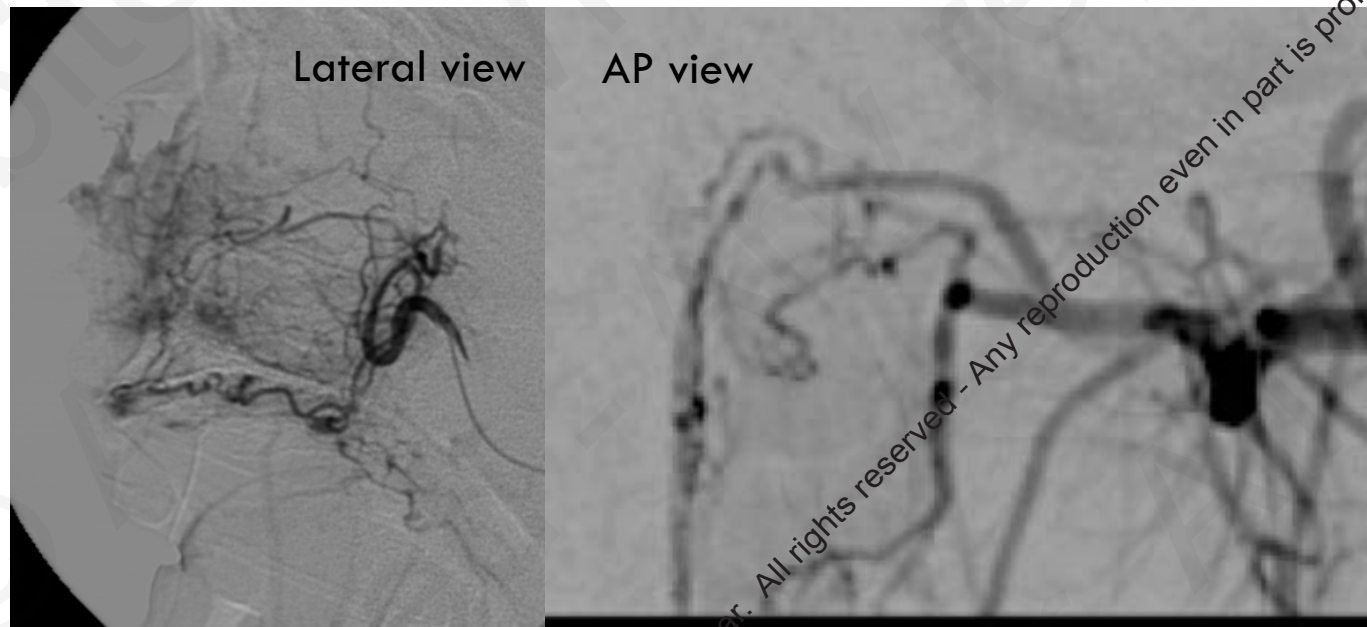
Septal anastomosis

Ant/Post Ethmoidal art (OA)

Septal br Sphenopalatine art (Imax)

Superior labial art (FA)

Greater palatine art (Imax) – posterior anastomosis with post ethmoidal artery



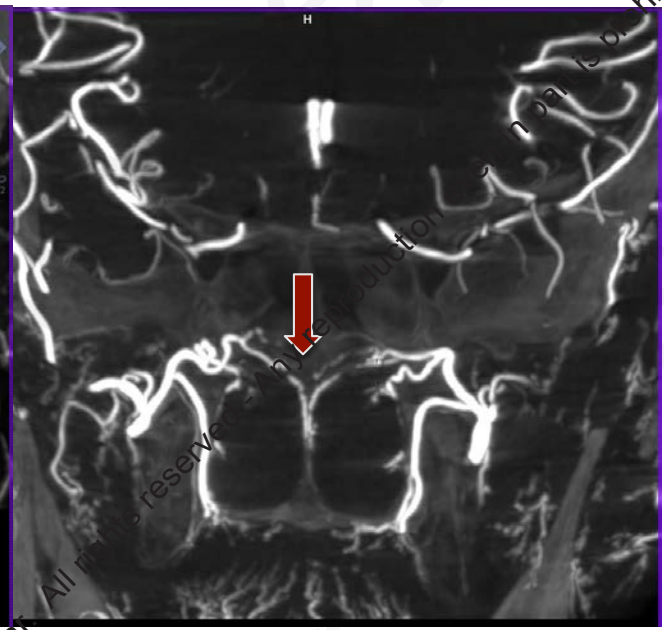
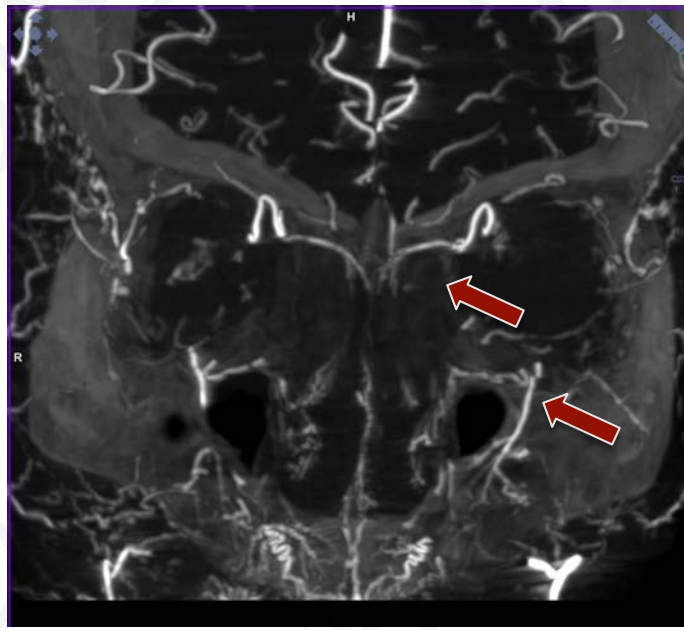
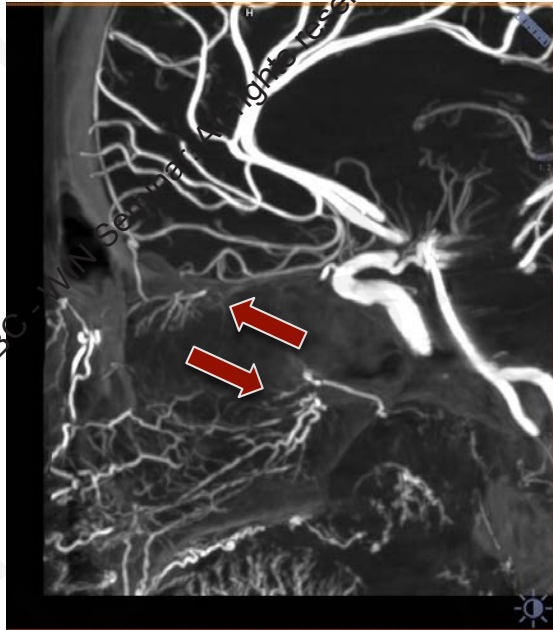
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■ Nasal fossa

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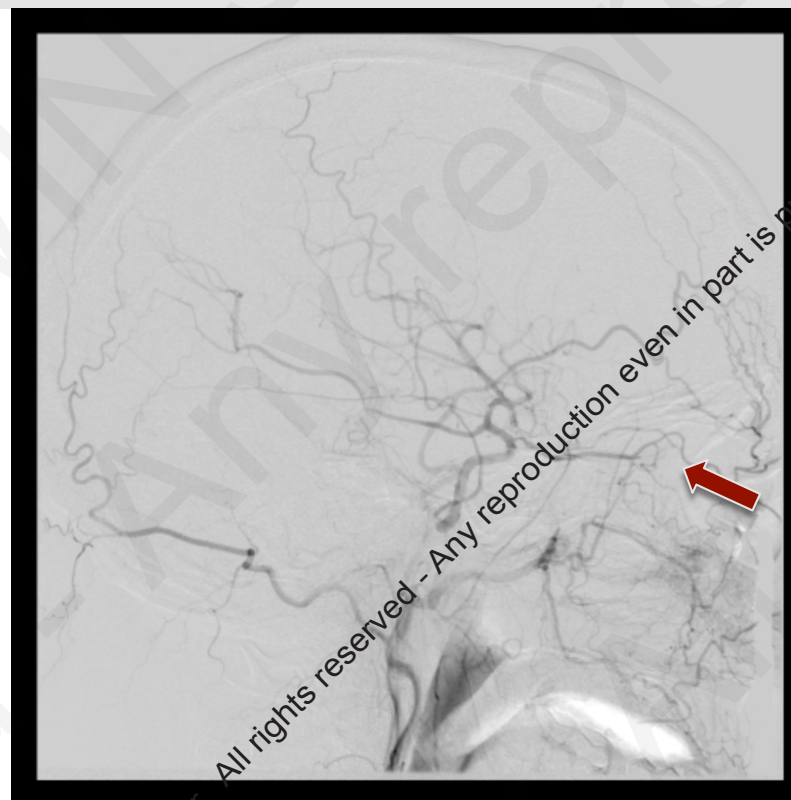
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Dangerous anastomosis of the anterior skull base

- Anatomical overview
 - Major anastomotic areas
(collateral circulation)
 - Nasal fossa (paranasal sinuses)
 - **Orbital (Distal / Proximal)**
 - Anterior skull base



Dangerous anastomosis of the anterior skull base

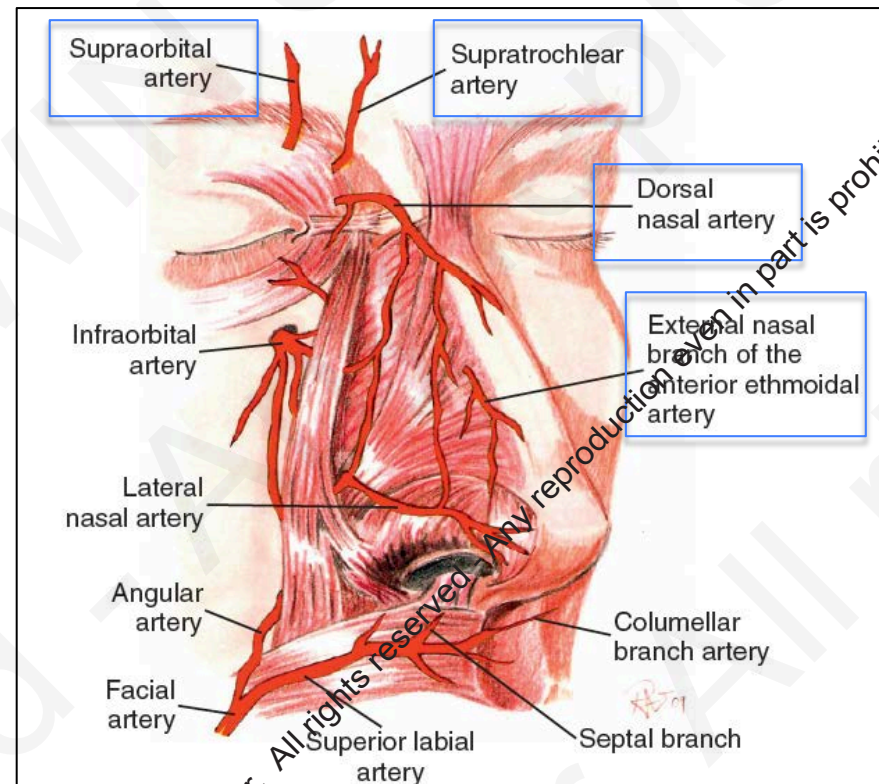


Orbit: Ophthalmic artery

Superficial / Distal OA anastomosis

Lacrimal / Dorsal Nasal / SupraOrbital /
SupraTrochlear / Palpebral arteries

- Internal maxillary artery
- Facial artery
- Superficial temporal artery



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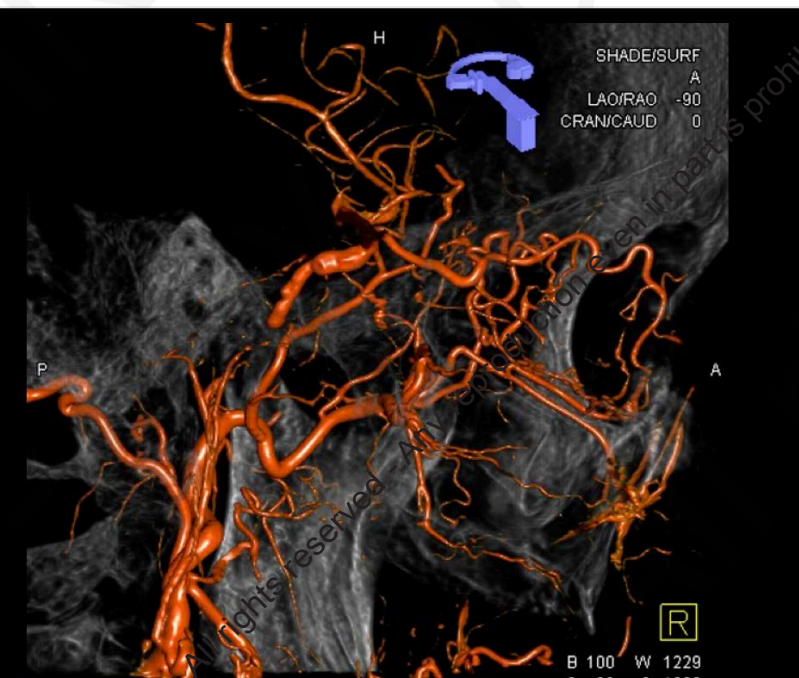
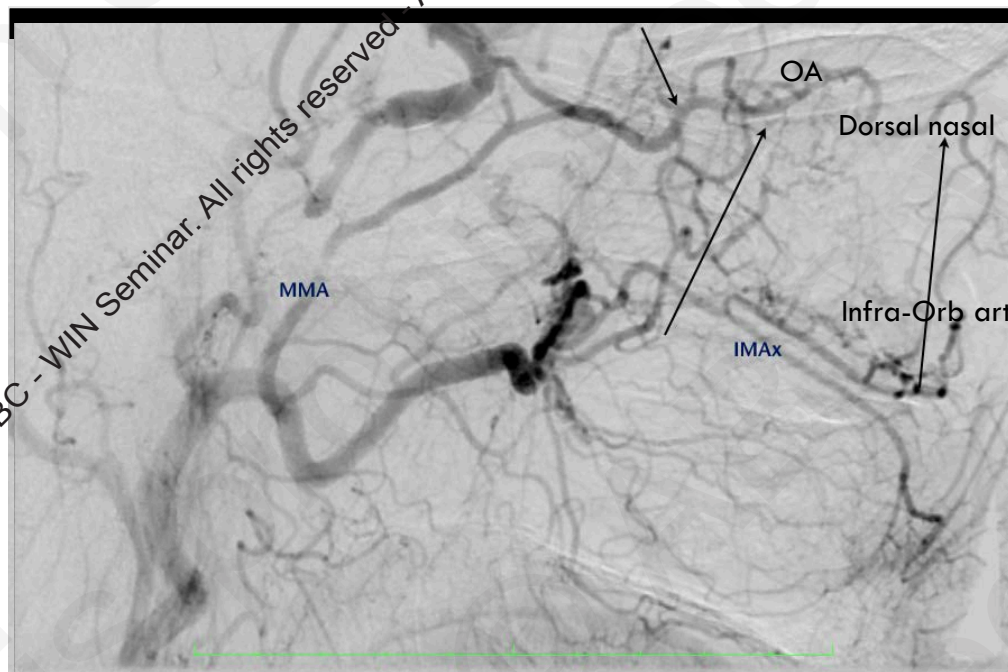
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Orbit: Ophthalmic artery

Distal OA anastomosis



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□ **Orbit: Ophthalmic artery**

Distal OA anastomosis



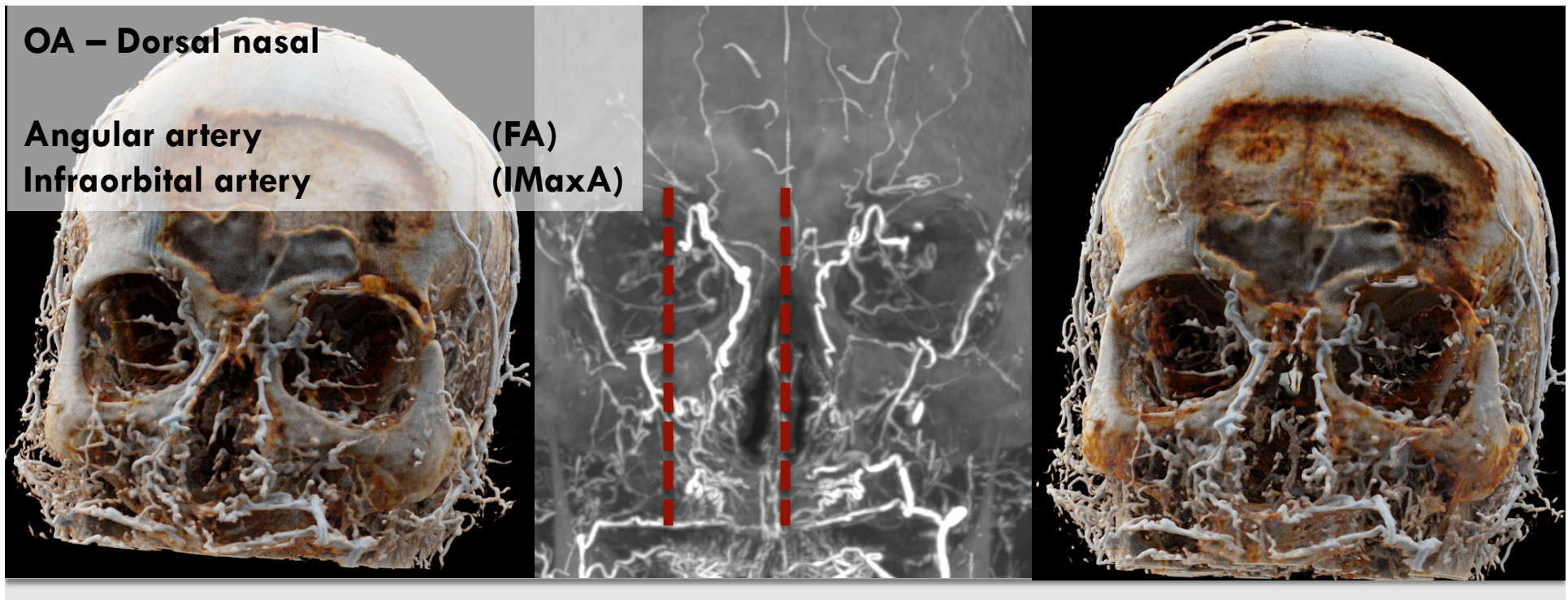
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□ Orbit: Ophthalmic artery

Distal OA anastomosis



Dangerous anastomosis of the anterior skull base



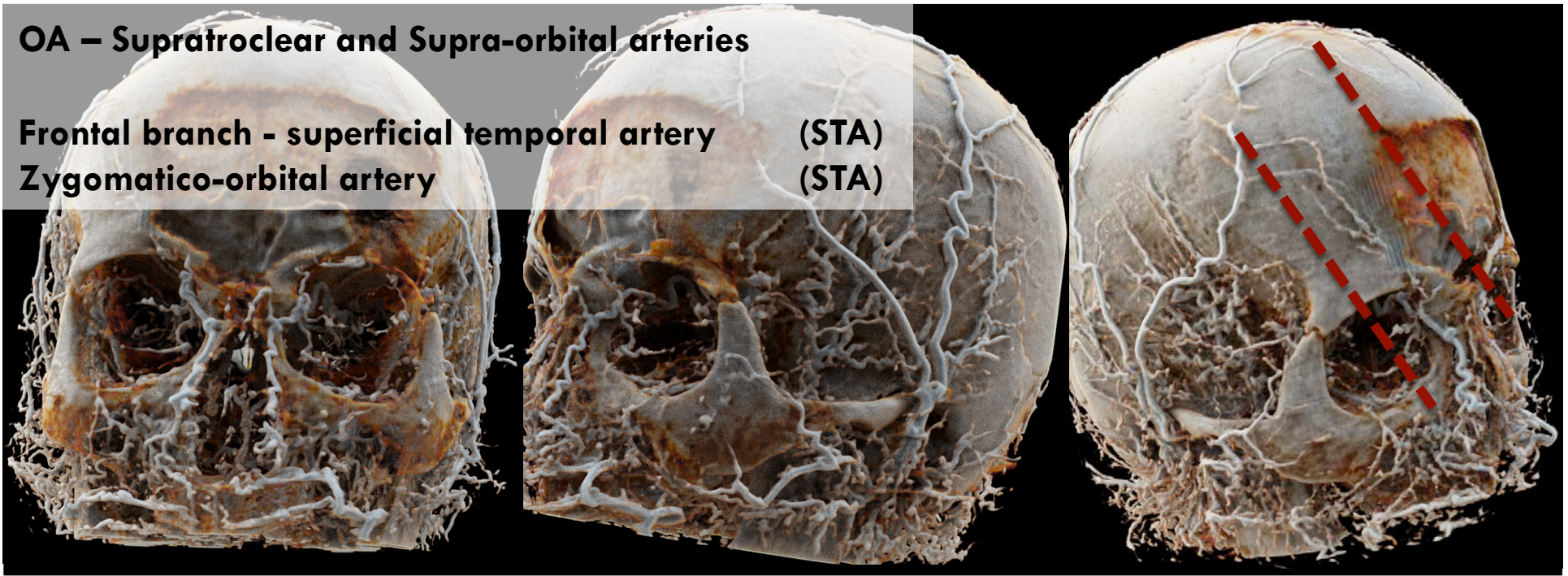
□ Orbit: Ophthalmic artery

Distal OA anastomosis

OA – Supratroclear and Supra-orbital arteries

Frontal branch - superficial temporal artery (STA)

Zygomatiko-orbital artery (STA)



Dangerous anastomosis of the anterior skull base

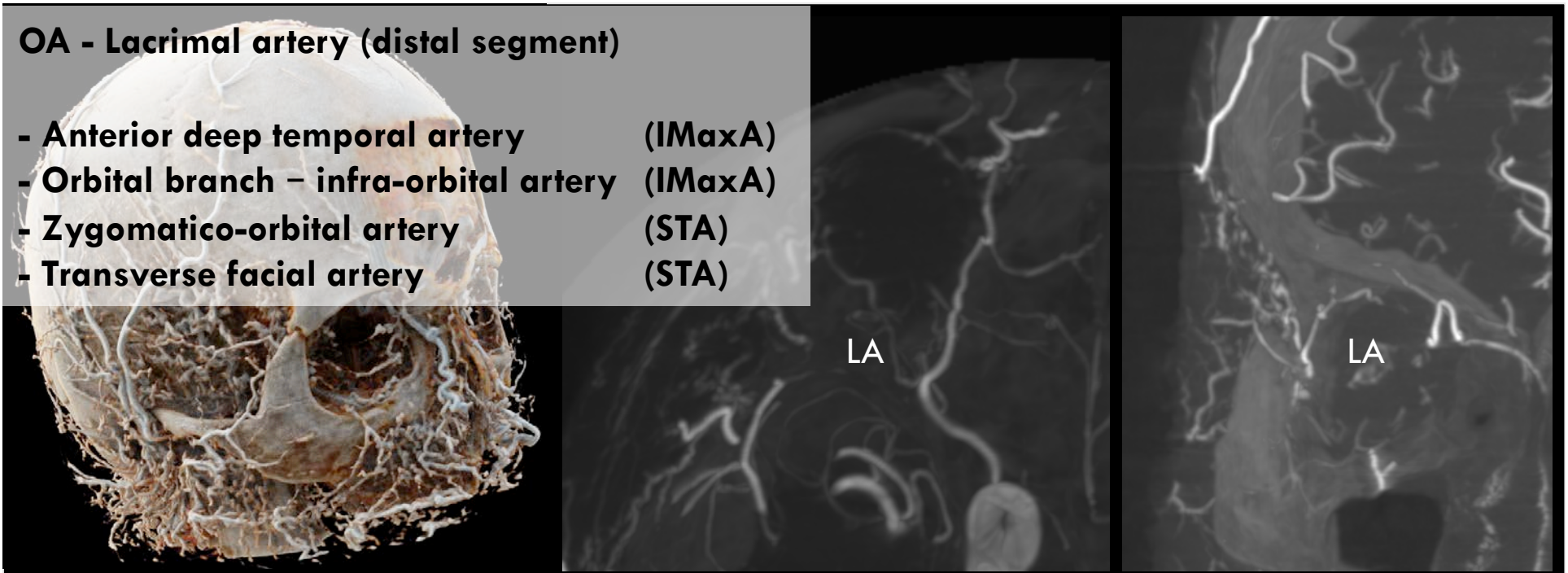


□ Orbit: Ophthalmic artery

Distal OA anastomosis

OA - Lacrimal artery (distal segment)

- Anterior deep temporal artery (IMaxA)
- Orbital branch – infra-orbital artery (IMaxA)
- Zygomatico-orbital artery (STA)
- Transverse facial artery (STA)



Dangerous anastomosis of the anterior skull base



□ Anatomical overview

■ Major anastomotic areas

(collateral circulation)

■ Nasal fossa (paranasal sinuses)

■ **Orbit (Distal / Proximal)**

■ Anterior skull base



Dangerous anastomosis of the anterior skull base

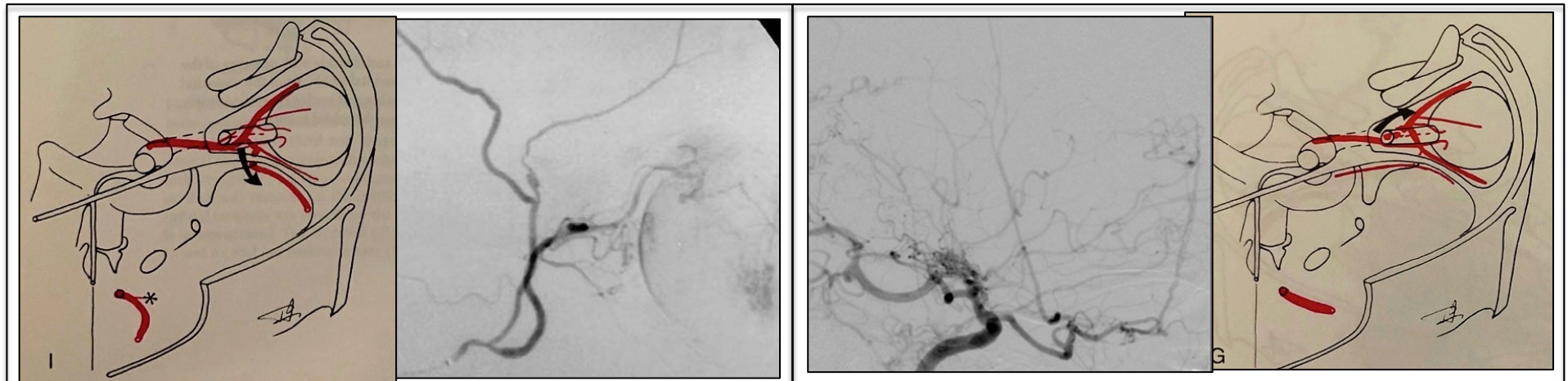


Dangerous anastomosis of the anterior skull base



■ Orbit: Ophthalmic artery (origin variants)

- OA originates from Middle Meningeal artery
 - Variation of the stapedial system



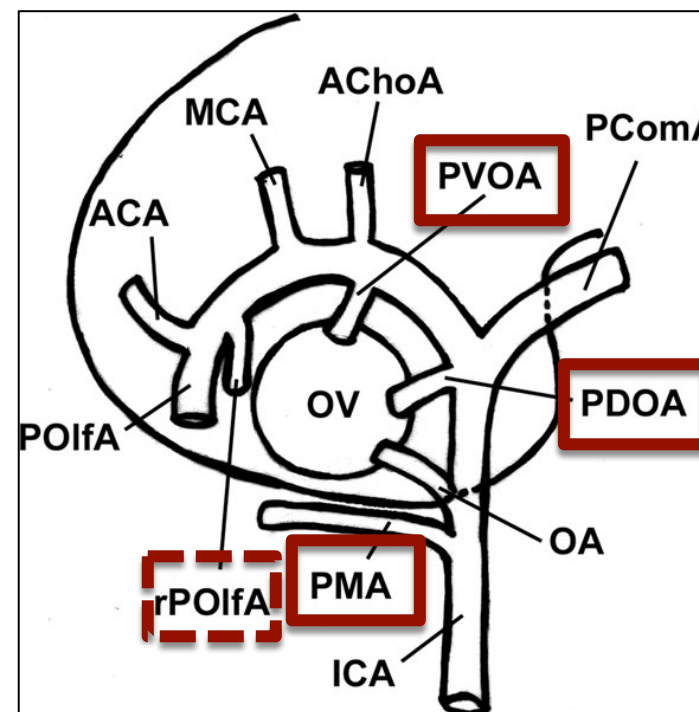
From: Lasjaunias P, Berenstein A, terBrugge K Surgical Neuro-angiography 2001

Dangerous anastomosis of the anterior skull base

Orbit: Ophthalmic artery (origin variants)

- OA originates from Middle Meningeal artery
 - Variation of the stapedia system

- Other OA origins
 - ICA Cavernous segment (persistence of the primitive maxillary artery PMA)
 - ICA supraclinoid segment (persistence of the primitive dorsal ophthalmic artery pDOphA or primitive ventral ophthalmic artery pVOphA)
 - ACA (persistence of the primitive olfactory artery POIfA)

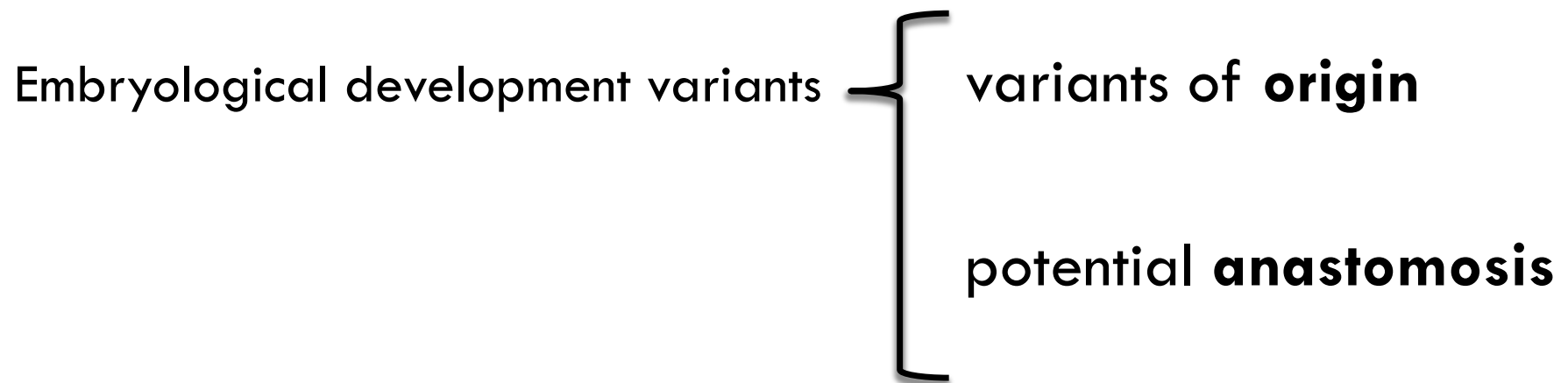


Adapted from Padgett DH (1948)

Dangerous anastomosis of the anterior skull base



- ❑ **Orbit:** Ophthalmic artery

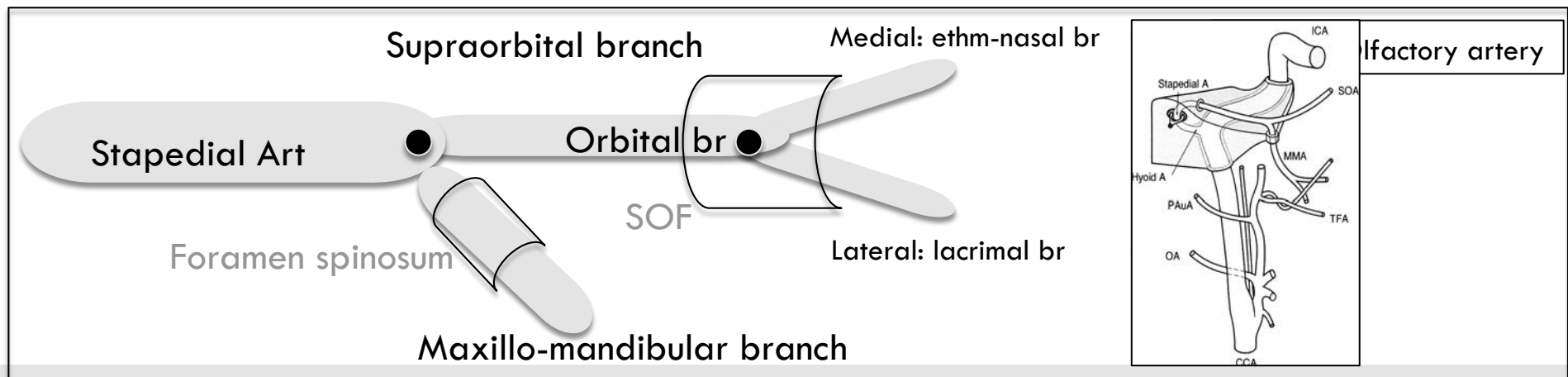


Dangerous anastomosis of the anterior skull base



□ Orbit: Ophthalmic artery: Stapedial artery (StA) system

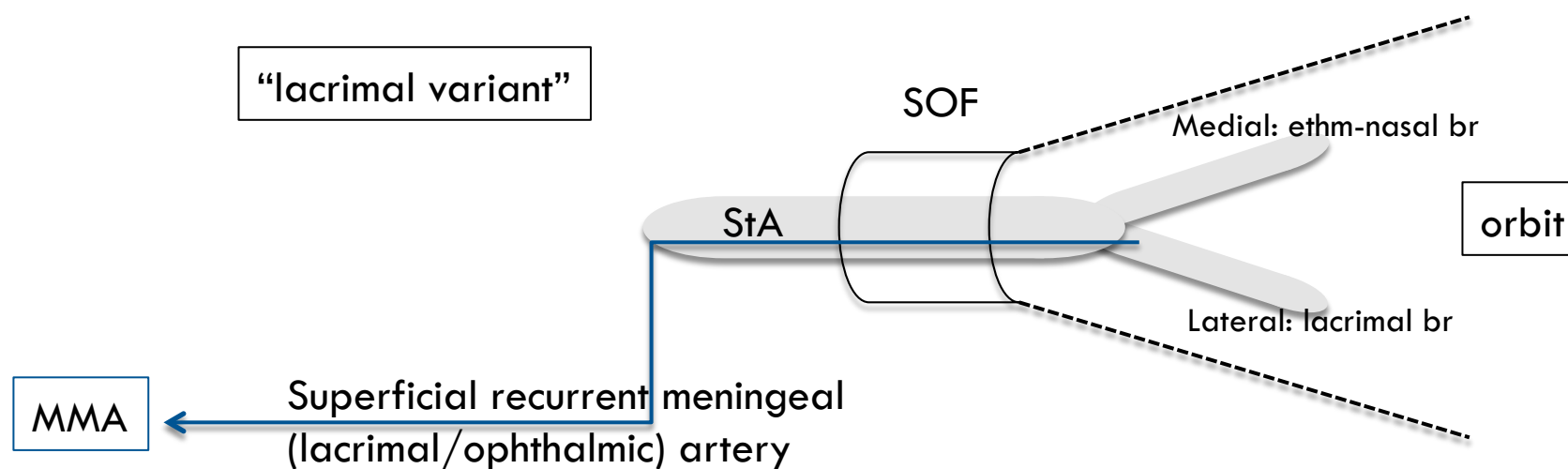
- OA – MMA anastomosis originate during the embryonic development of the stapedial artery
- Stapedial artery branches:
 - Supraorbital division → intracranial MMA + extraocular OA
 - Maxillo-mandibular division → I max A and extracranial MMA





Dangerous anastomosis of the anterior skull base

- ❑ **Orbit:** Ophthalmic artery: Stapedial artery (StA) system
- ❑ Stapedial artery (StA): intra-orbital division of the supra-orbital artery (~70% of cases)



Dangerous anastomosis of the anterior skull base



□ Ophthalmic artery

- Superficial recurrent meningeal (lacrima/ophthalmic) artery

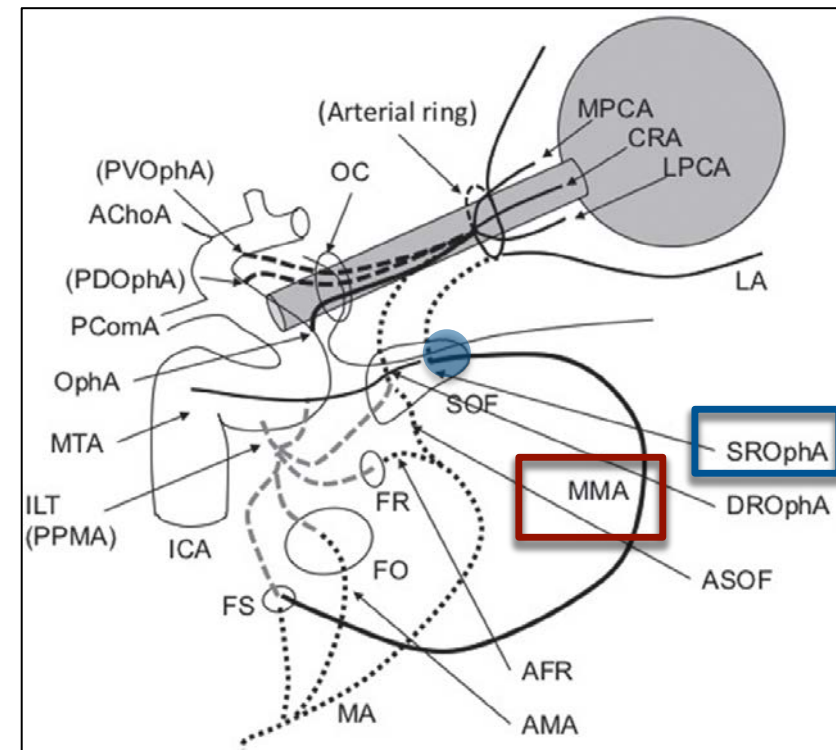
OA - **Lacrima artery** (superficial recurrent meningeal branch)

→ **SOF**

→ anastomose

→ MMA orbital branches and

→ ILT (superior/tentorial branch)

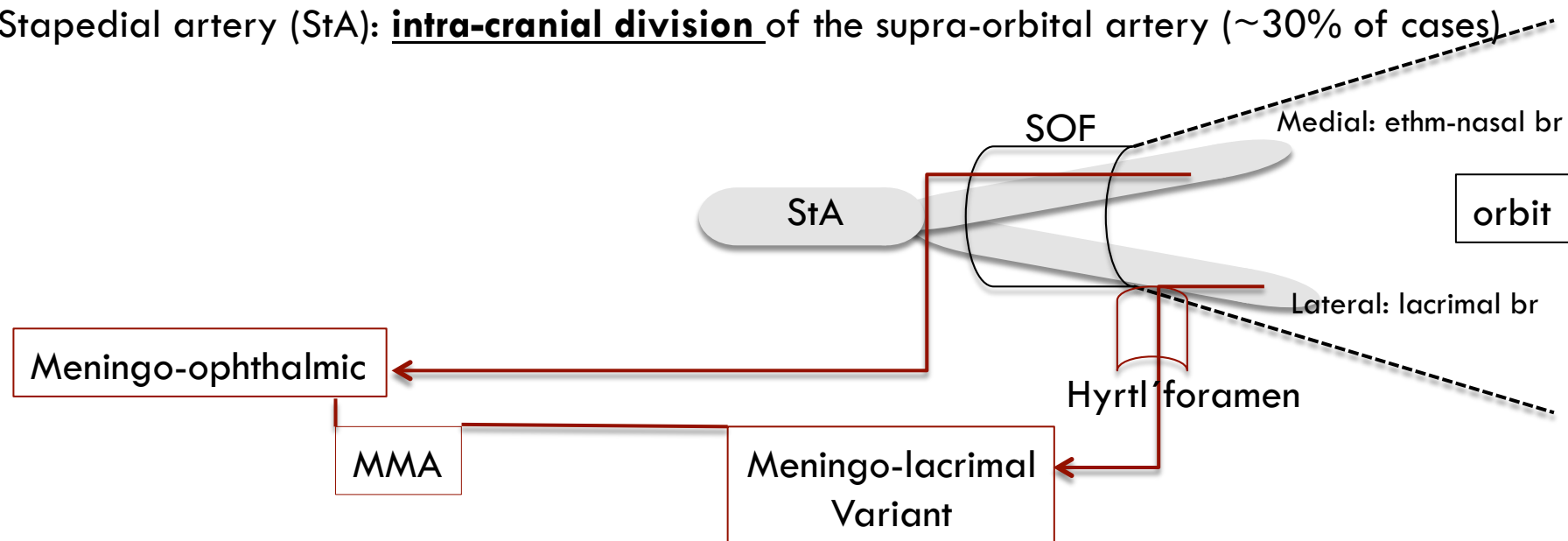


From: Toma N Neurol Med Chir (Tokyo 2016)

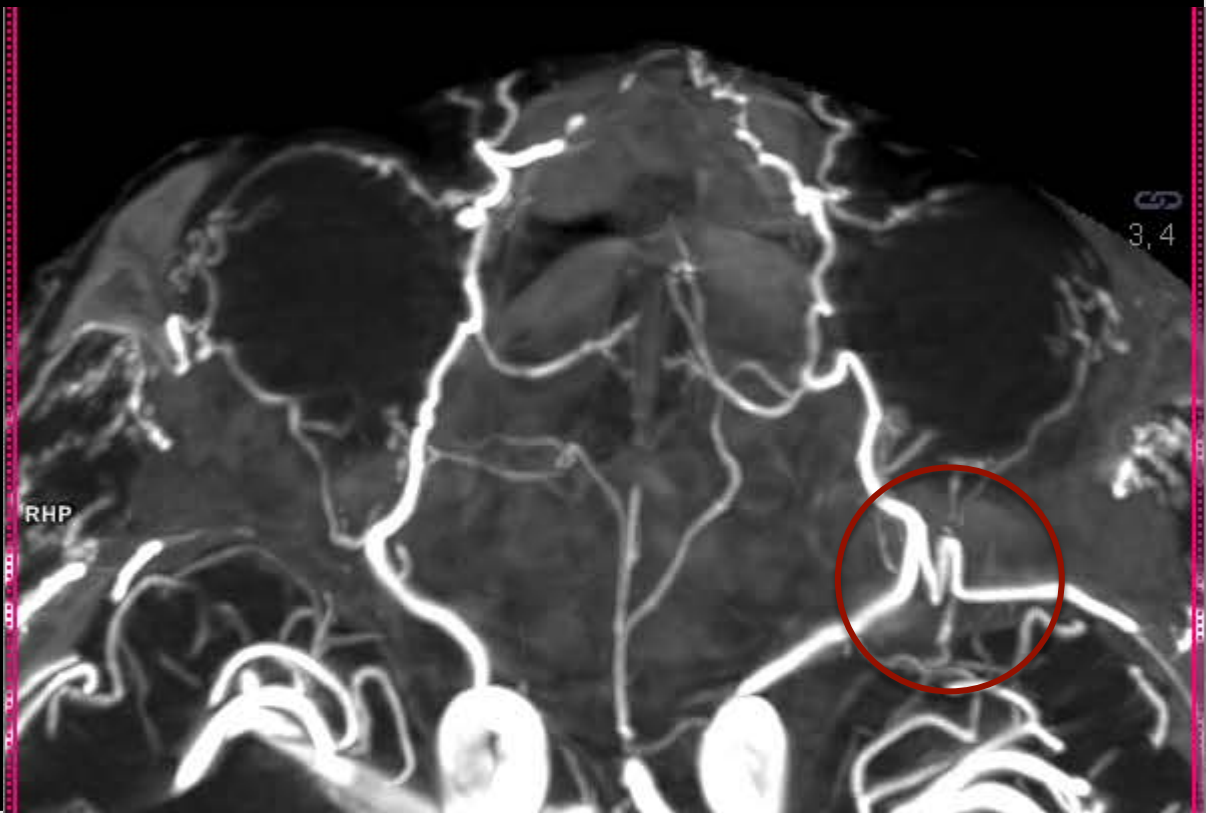
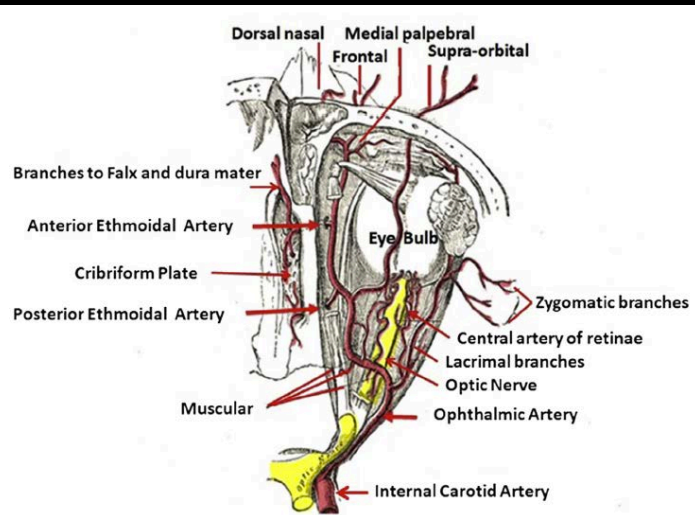


Dangerous anastomosis of the anterior skull base

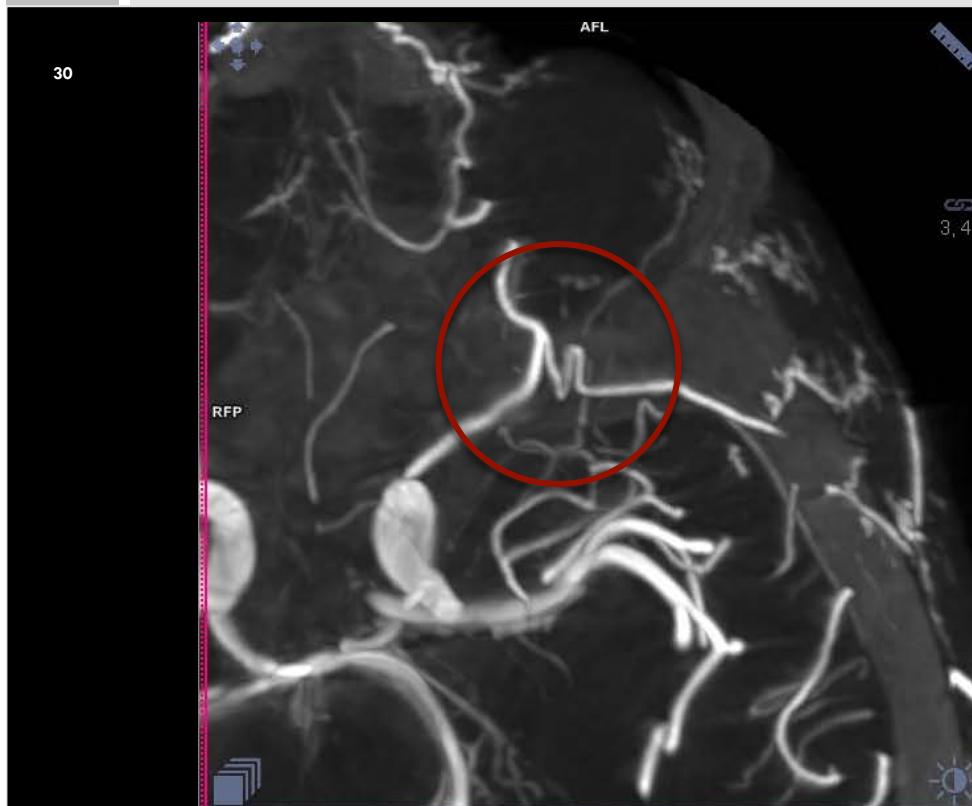
- **Orbit:** Ophthalmic artery: Stapedial artery (StA) system
- Stapedial artery (StA): intra-cranial division of the supra-orbital artery (~30% of cases)



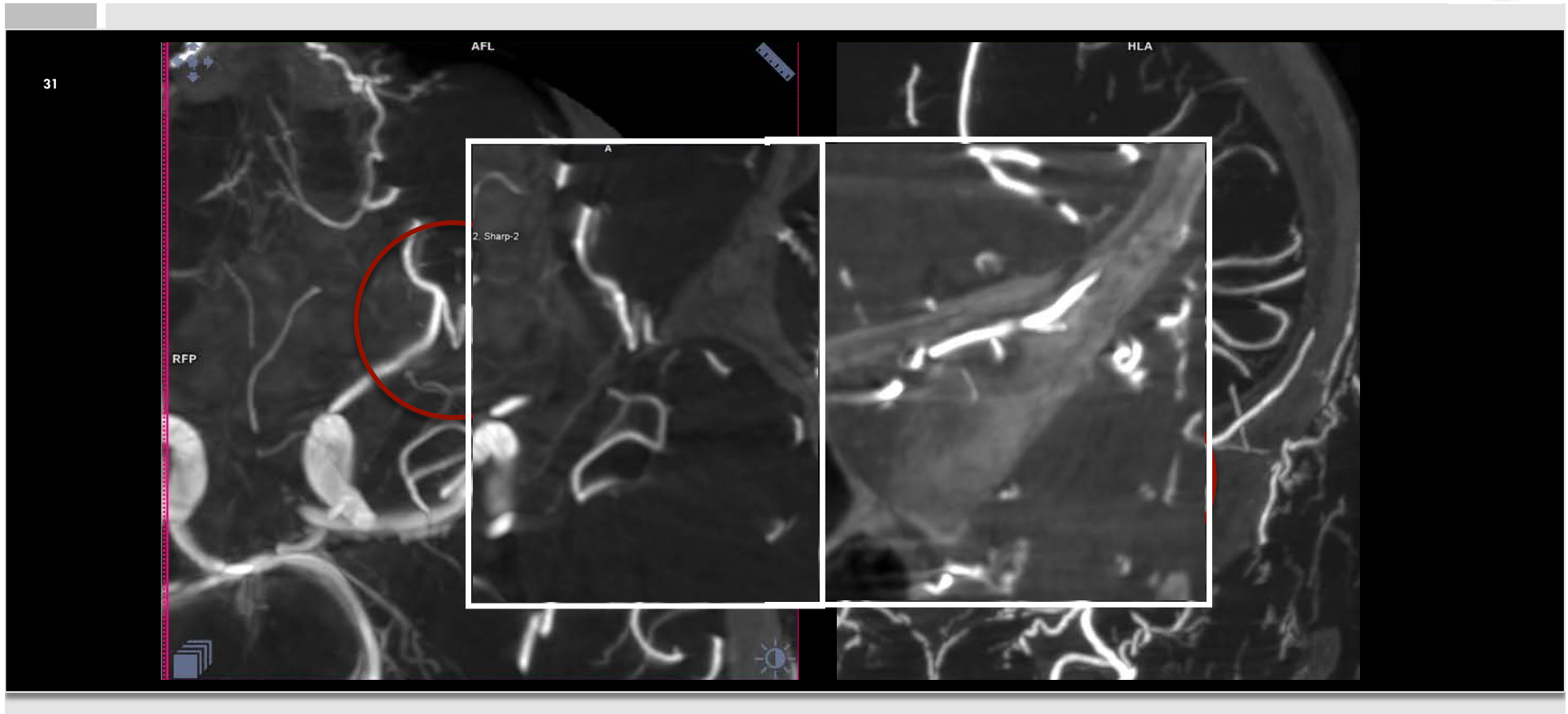
Dangerous anastomosis of the anterior skull base



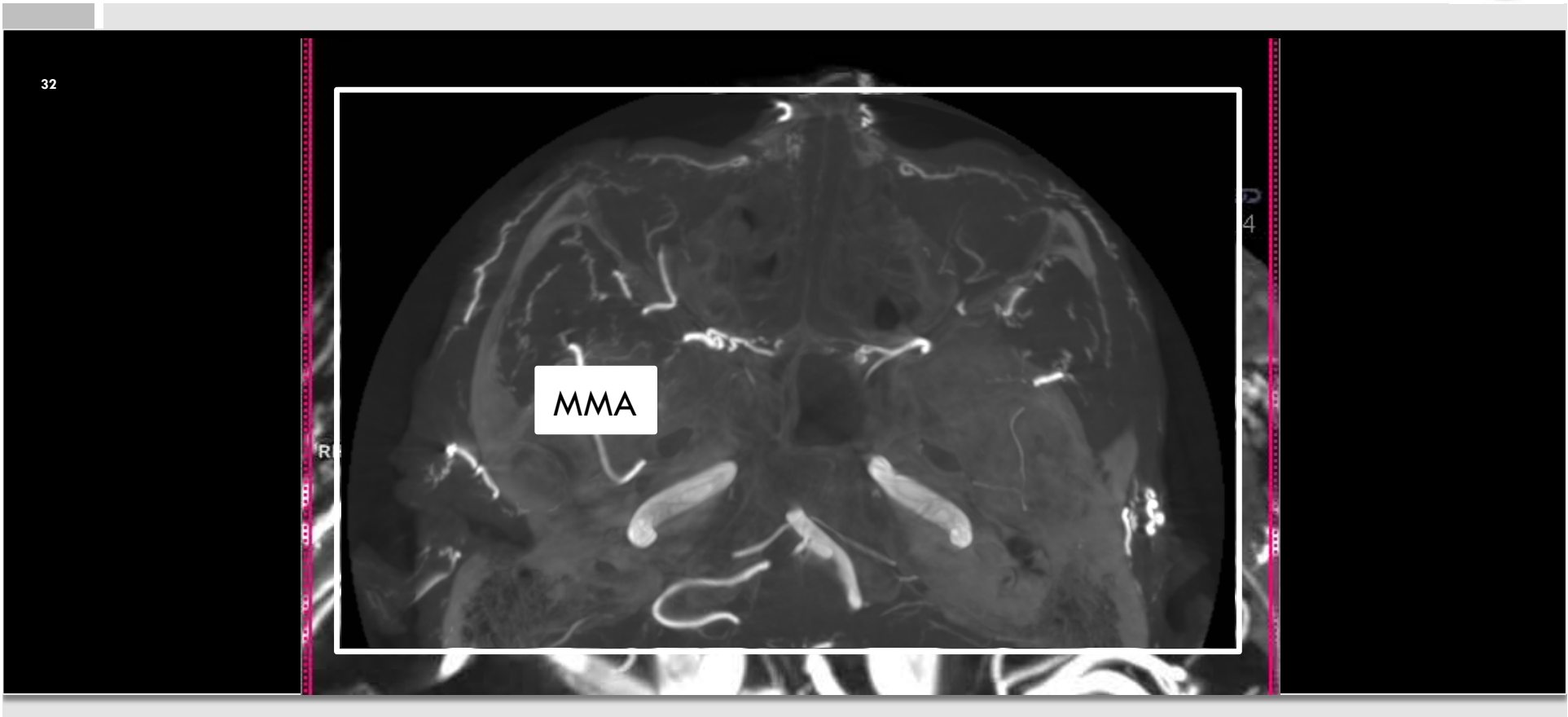
Dangerous anastomosis of the anterior skull base



Dangerous anastomosis of the anterior skull base



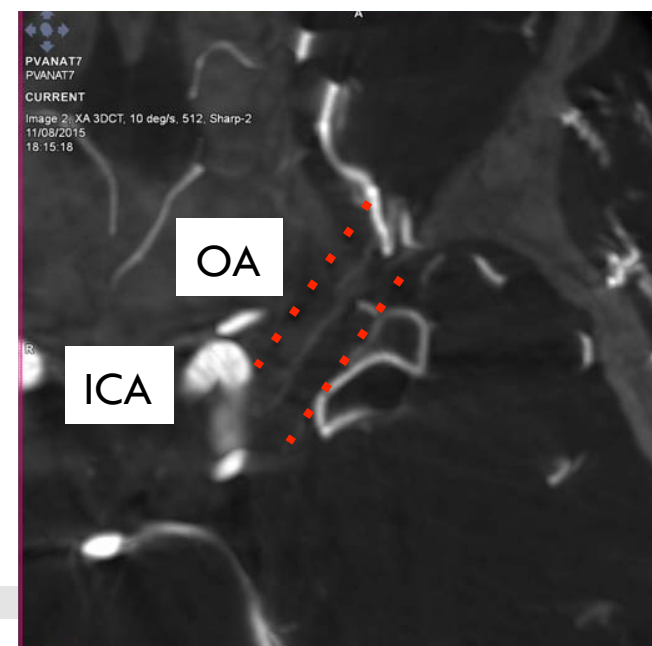
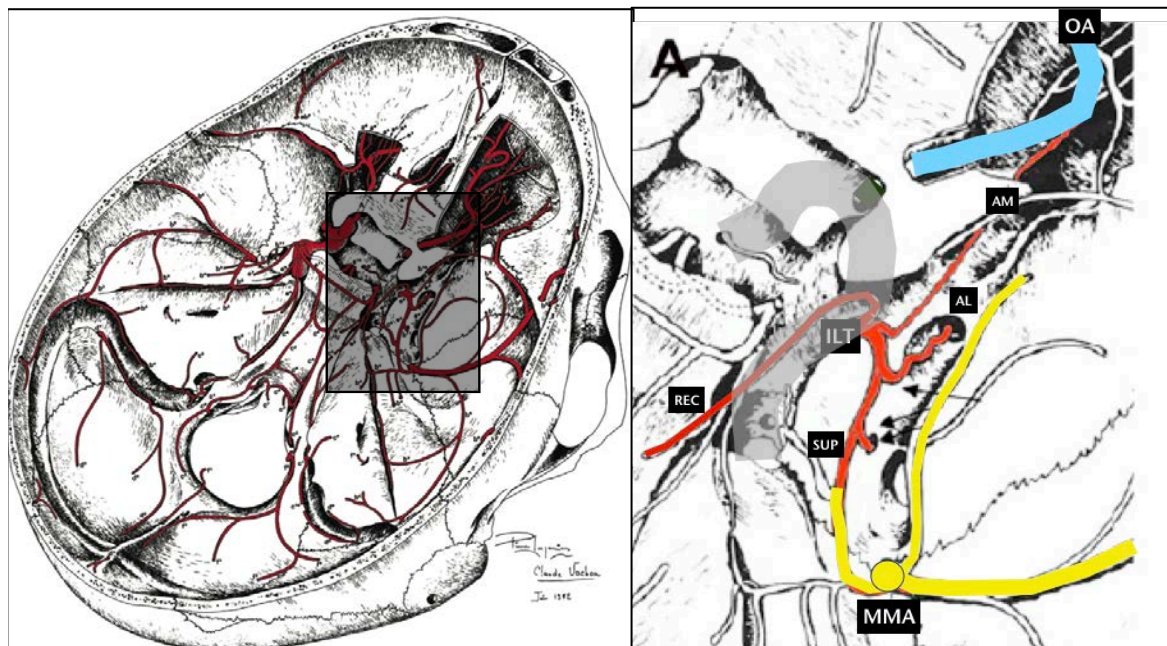
Dangerous anastomosis of the anterior skull base



Dangerous anastomosis of the anterior skull base

■ Ophthalmic artery: Deep recurrent meningeal artery

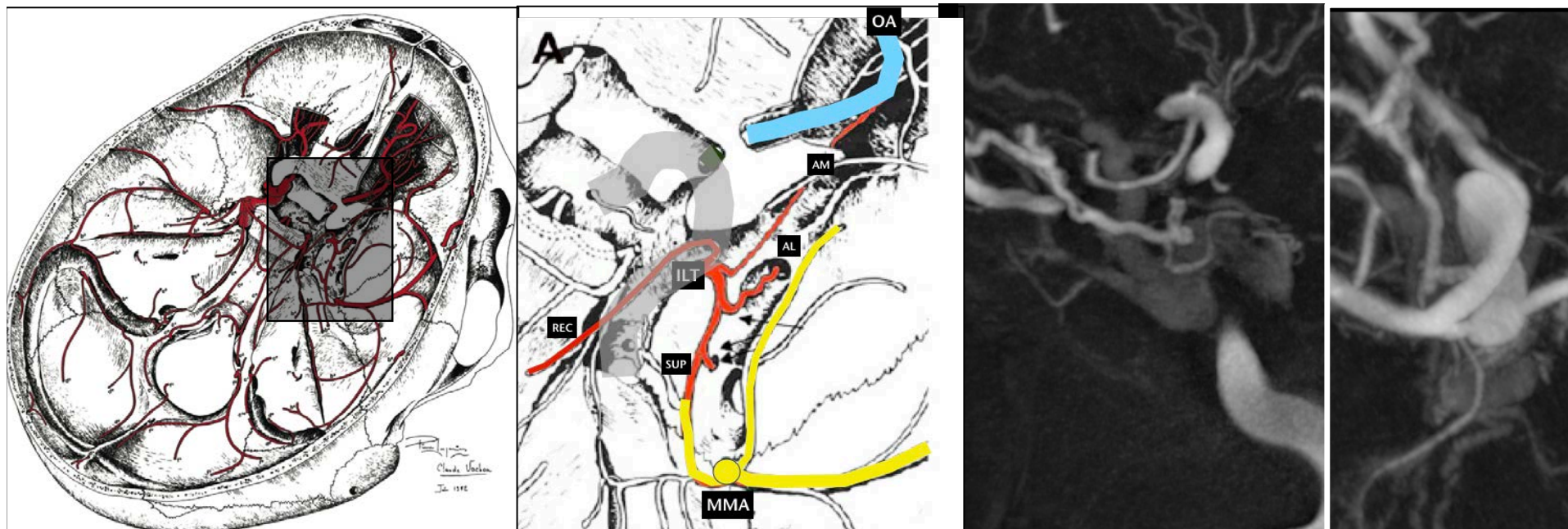
- Remnant of the PMA (primitive maxillary artery)
- OA → SOF → anastomose → ILT (AM anteromedial br)



Dangerous anastomosis of the anterior skull base

□ Ophthalmic artery: Deep recurrent meningeal artery

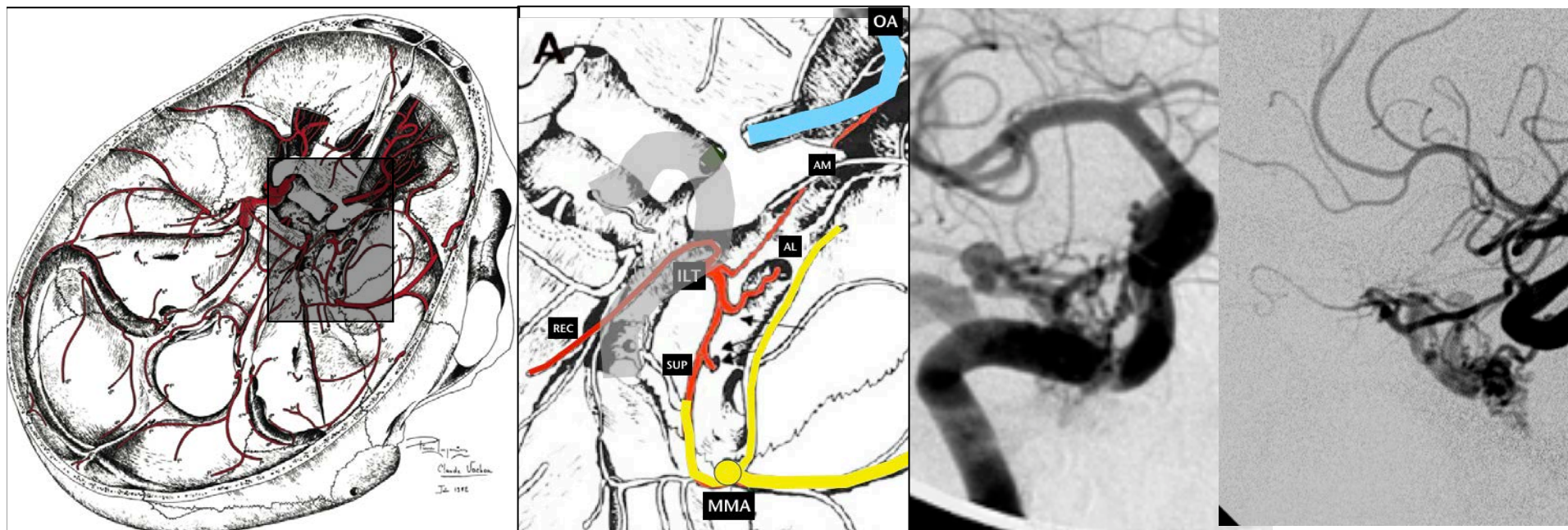
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Dangerous anastomosis of the anterior skull base

□ Ophthalmic artery: Deep recurrent meningeal artery

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Dangerous anastomosis of the anterior skull base

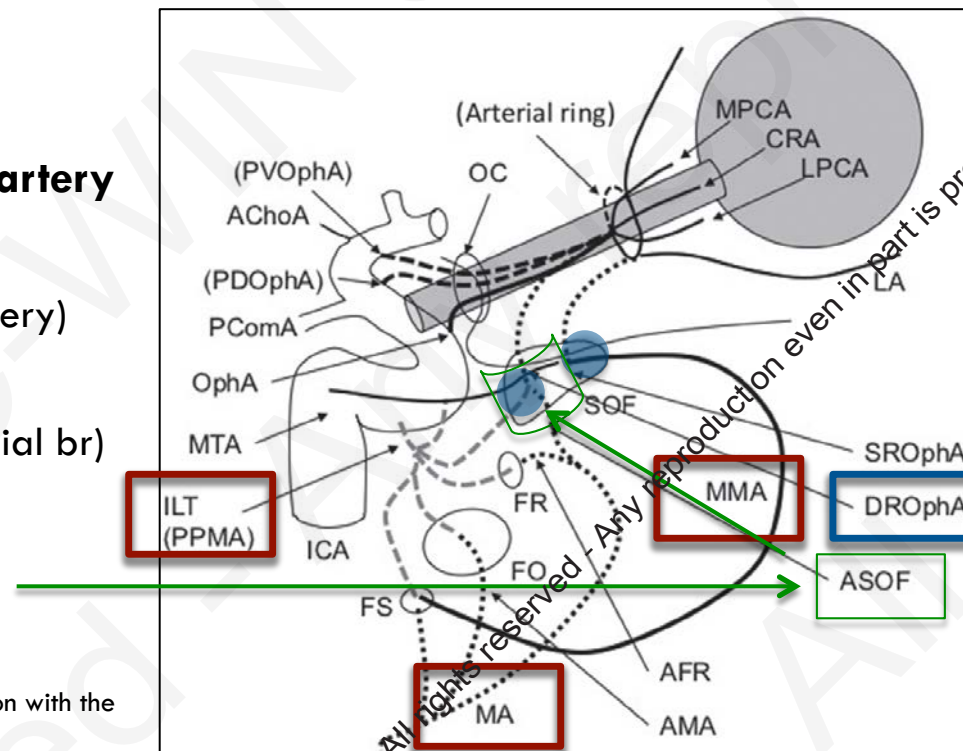
Ophthalmic artery

Deep recurrent meningeal (ophthalmic) artery

- Remnant of the PMA (primitive maxillary artery)
- OA → SOF → anastomose → ILT (anteromedial br)

Artery of the SOF (superior orbital fissure):

- Small ascending Internal Maxillary artery branch
- that anastomosis at the level of the SOF with
- ILT (anteromedial branch) and secondarily is in connection with the deep recurrent meningeal artery



From: Toma N Neurol Med Chir (Tokyo 2016)

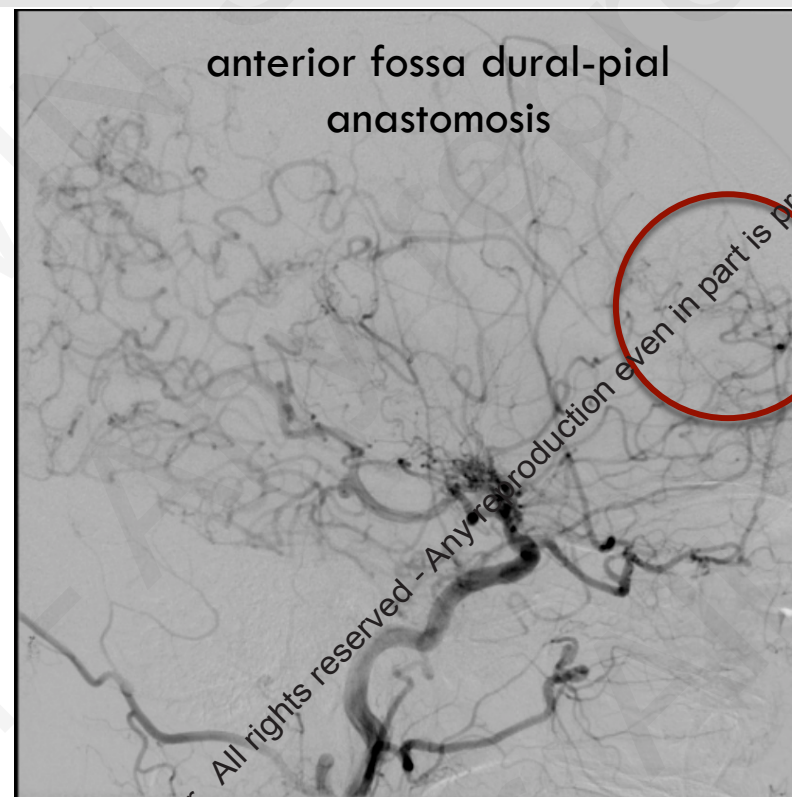
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Dangerous anastomosis of the anterior skull base

- Anatomical overview
 - Major anastomotic areas
(collateral circulation)
 - Nasal fossa (paranasal sinuses)
 - Orbit (Distal / Proximal)
 - Anterior skull base



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Dangerous anastomosis of the anterior skull base

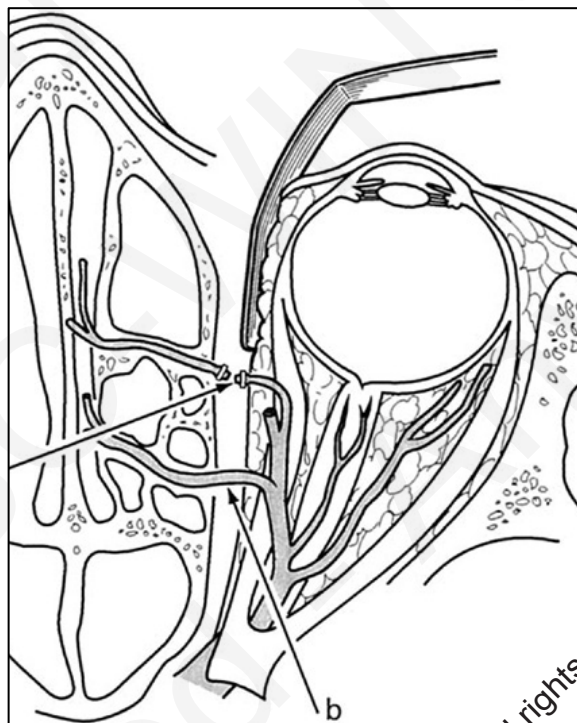
□ Ophthalmic artery: collaterals

■ Posterior Ethmoidal artery

- Passes through the posterior ethmoidal canal at the junction of the planum sphenoidale and the cribriform plate
- Anastomosis: Posterior ethmoidal arteries → Middle meningeal artery

■ Anterior Ethmoidal artery

- Passes through the anterior ethmoidal canal at the posterior aspect of the frontal recess
- Anastomosis: anterior falcine artery → Middle Meningeal artery



From: Demo MM in Current Therapy in Oral and Maxillofacial Surgery (2012)

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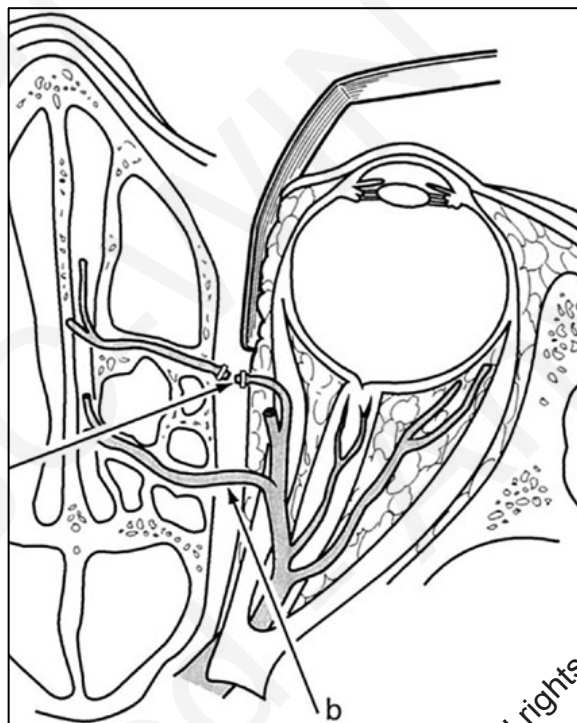
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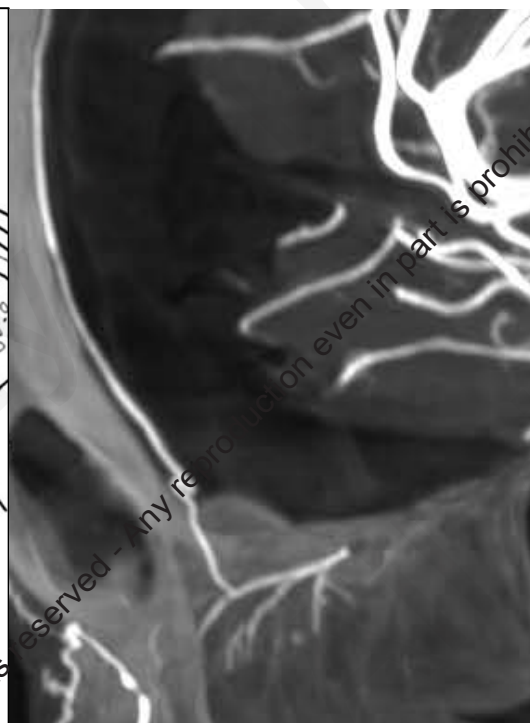
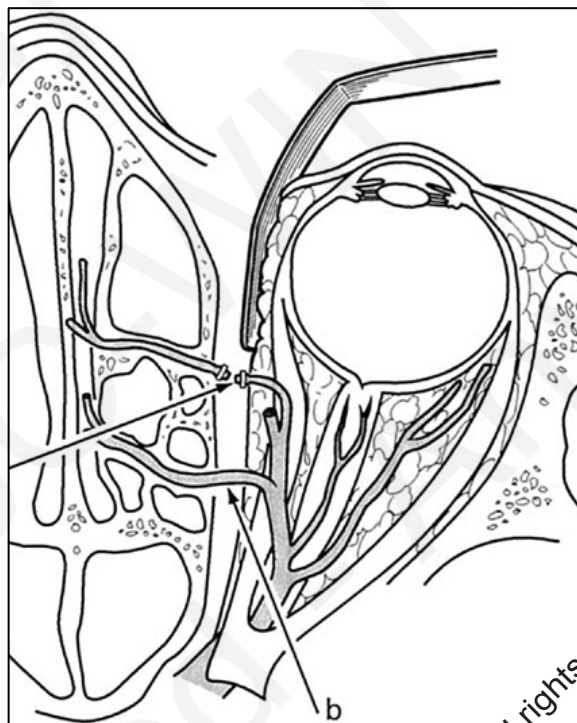
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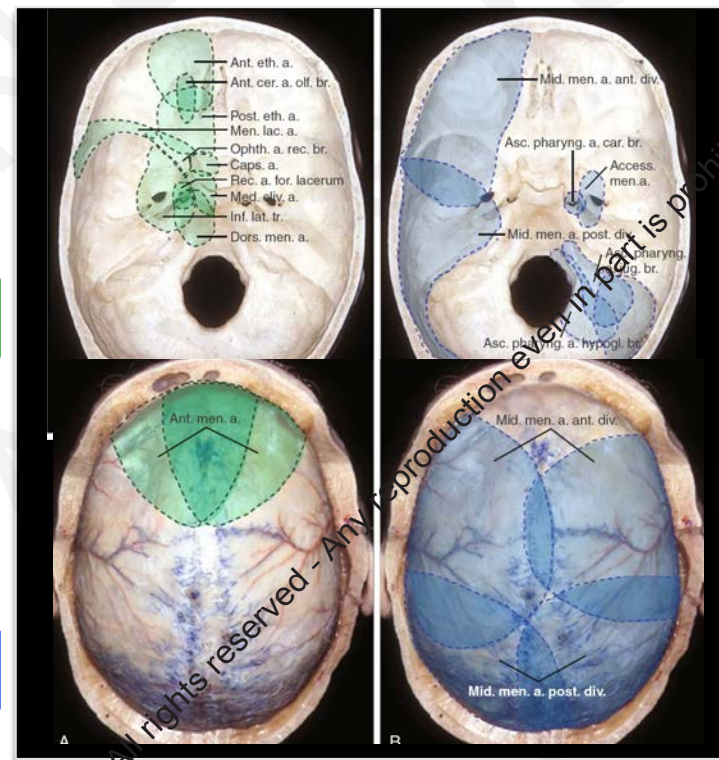
Dangerous anastomosis of the anterior skull base

□ Anatomical overview: dural arterial supply

- Ophthalmic artery
 - Anterior and posterior ethmoidal arteries
 - Superficial recurrent meningeal artery
 - Lacrimal branches
- Anterior cerebral artery
 - Olfactory branches (fronto-orbital art)
 - Branches to the falx (pericallosal art)
- Middle meningeal artery

medial

lateral



From: Seker A Meningeal anatomy in Meningiomas a comprehensive text (2010)

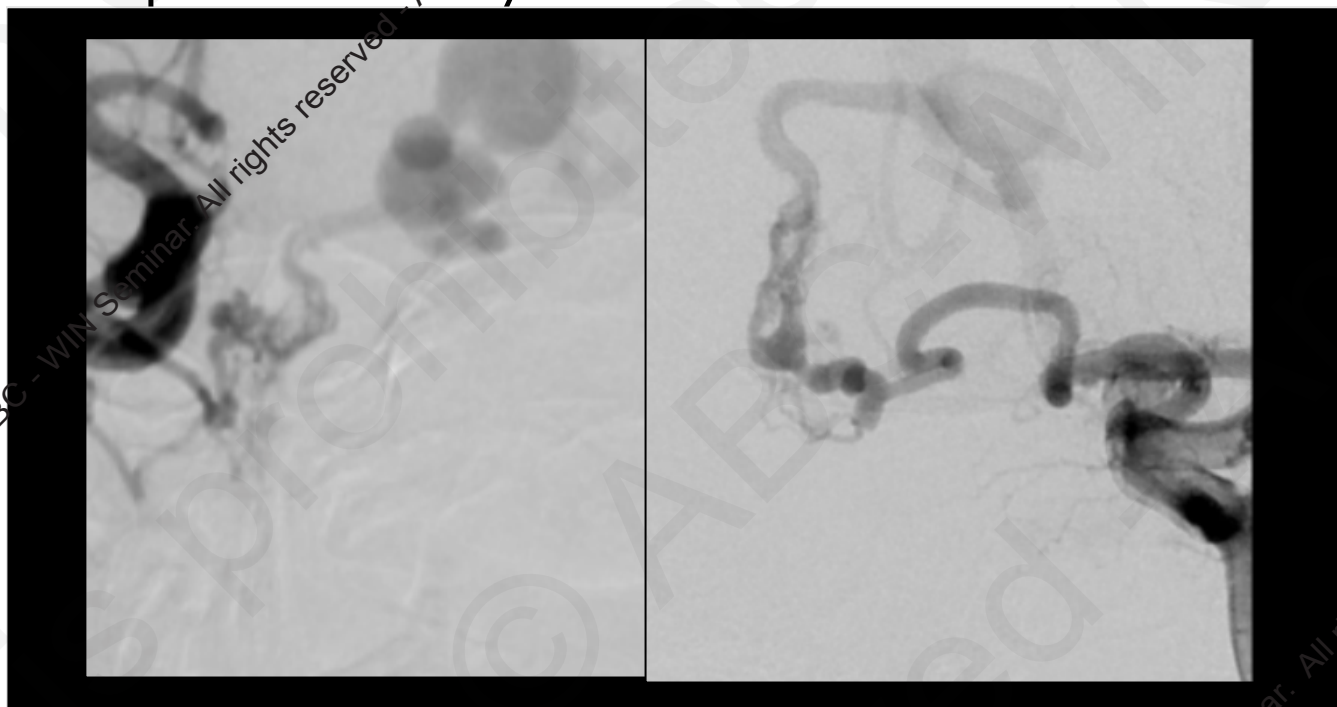
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□ Ophthalmic artery: Ethmoidal arteries



Lateral epidural AVF
(osteo-cartilaginous-epidural)

Related with pial venous drainage
(CVR+)

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- ▣ Ophthalmic artery: Ethmoidal arteries



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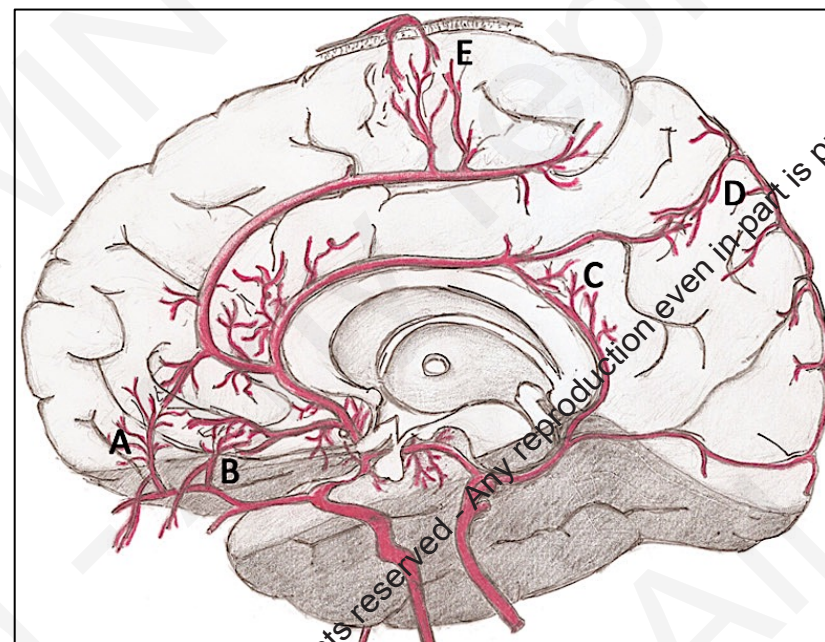
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Dangerous anastomosis of the anterior skull base

Anterior Cerebral Artery (ACA)

- Dural pial cortical anastomosis
 - Anterior ethmoidal artery (anterior palcine artery)
 - Frontopolar artery
 - Caloso marginal art.
 - Anteromedial art.
 - Posterior ethmoidal artery
 - Fronto-orbital art.
- MMA / Lacrimal Artery (superficial recurrent meningeal artery) – ACA - MCA branches



From: Robert T AJNR 2018

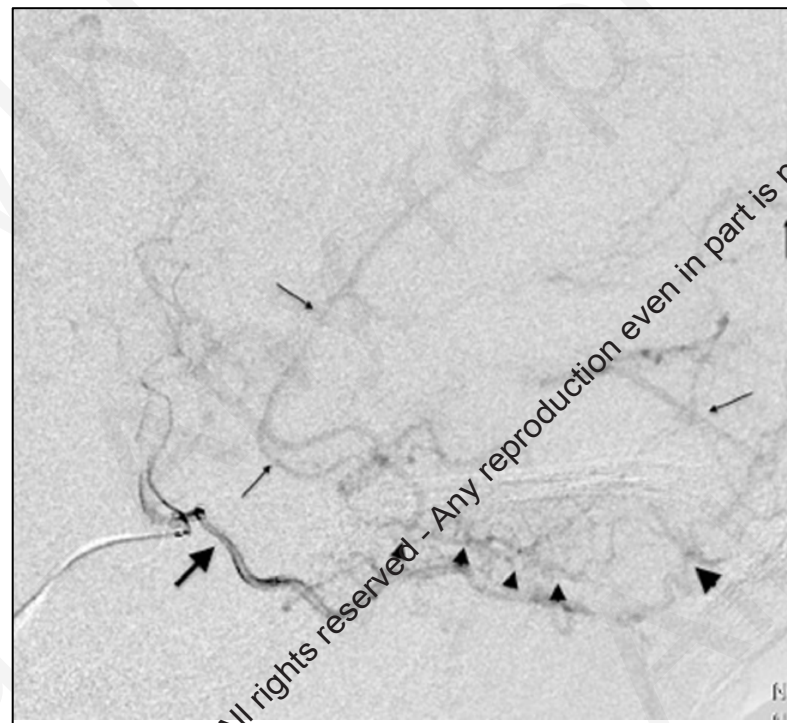
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Dangerous anastomosis of the anterior skull base

- Anterior Cerebral Artery (ACA)
 - Dural pial/cortical anastomosis
 - Anterior ethmoidal artery (anterior palcine artery)
 - Frontopolar artery
 - Caloso marginal art.
 - Anteromedial art.
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 - MMA / Lacrimal Artery (superficial recurrent meningeal artery) – ACA - MCA branches



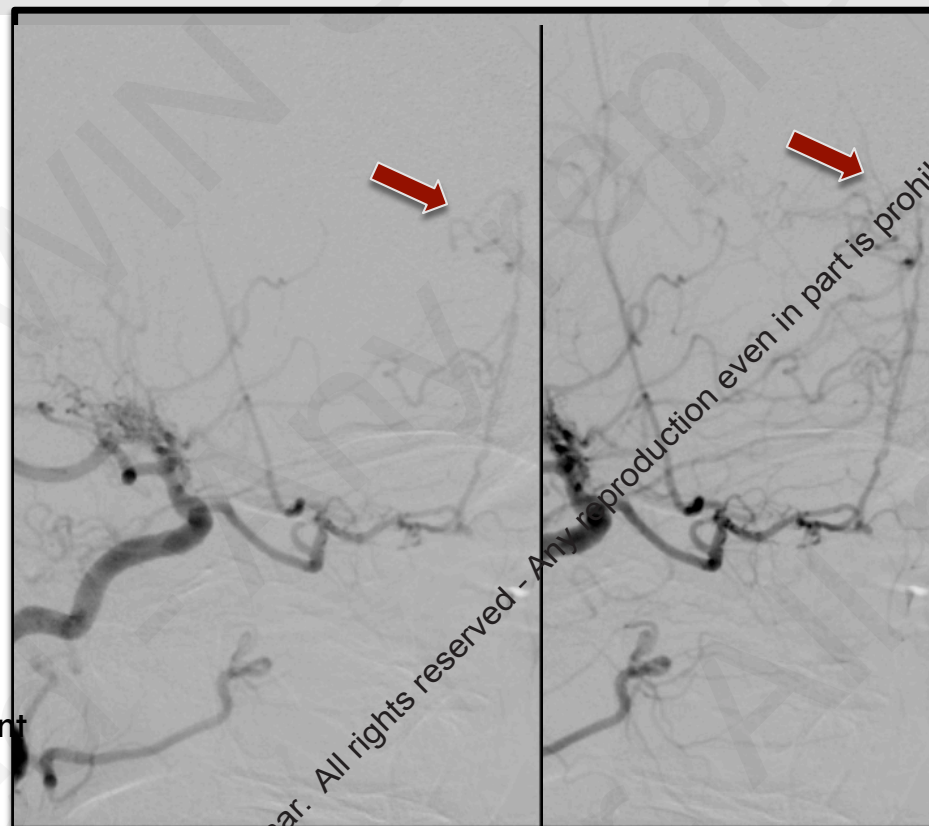
From: Baltšavias G ChNSyst 2015



Dangerous anastomosis of the anterior skull base

Anterior Cerebral Artery (ACA)

- Dural pial cortical anastomosis
 - Anterior ethmoidal artery (anterior ciliary artery)
 - Frontopolar artery
 - Caloso marginal art.
 - Anteromedial art.
 - Posterior ethmoidal artery
 - Fronto-orbital art.
- MMA / Lacrimal Artery (superficial recurrent meningeal artery) – ACA - MCA branches



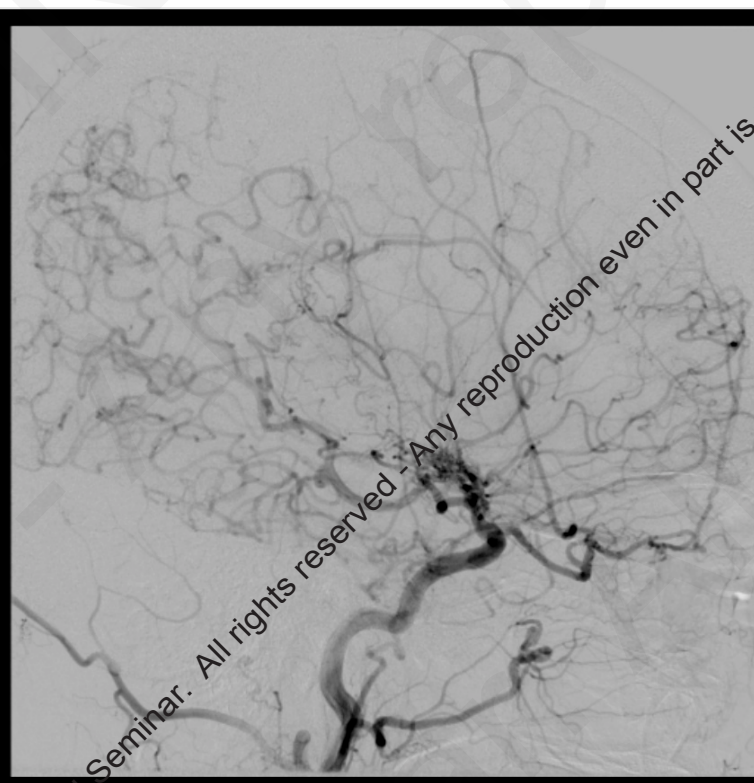
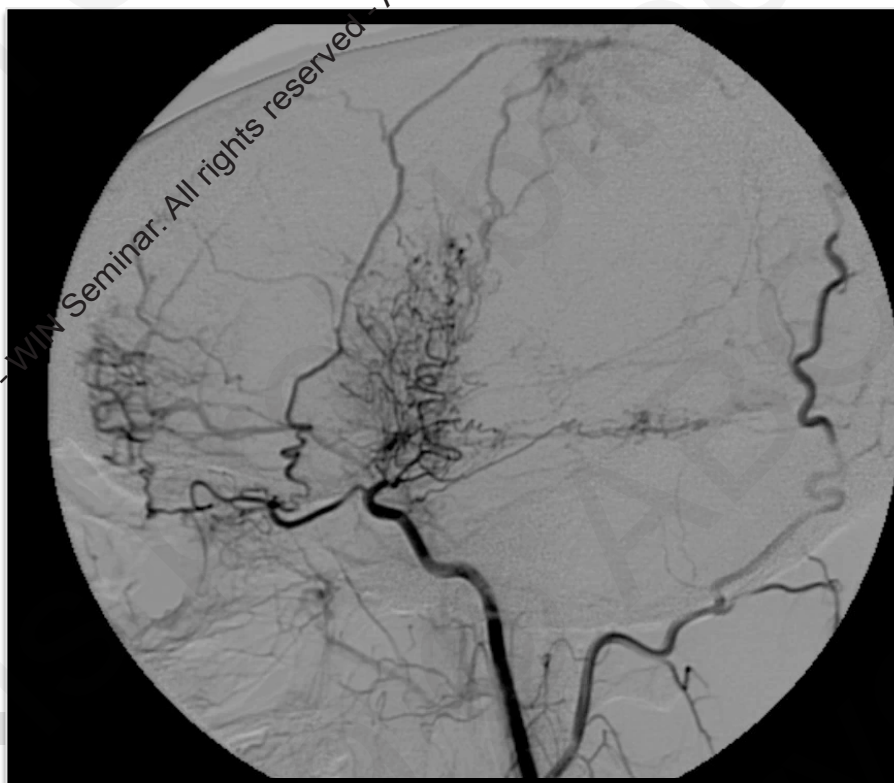
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Dangerous anastomosis of the anterior skull base

Anterior Cerebral Artery (ACA)



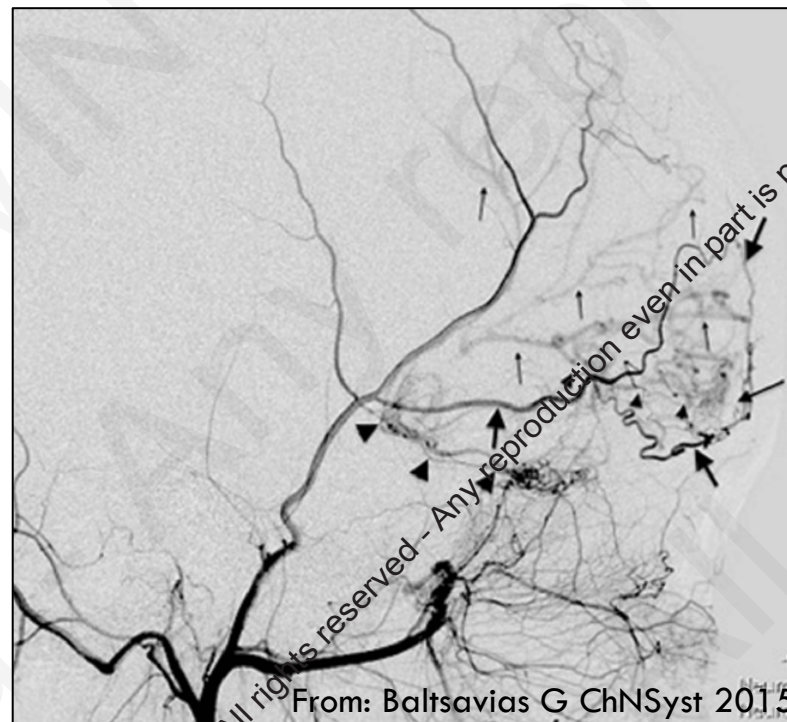
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Dangerous anastomosis of the anterior skull base

Exocranial

Nasal fossa

Orbit

Endocranial

Nasal septum

Superficial / Distal anastomosis

Proximal anastomosis

Dural / dural-pial anastomosis

IMAX art (sphenopalatine art) ↔
OA (ethmoidal arts)

OA (Lacrimal / Dorsal Nasal / SupraOrbital / SupraTrochlear / palpebral arts) ↔ **Internal maxillary art / Facial art / Superficial temporal art**

OA ↔ **MMA art** (Superficial recurrent meningeal art, Meningo-ophthalmic art, Meningo-lacrimal art)
OA ↔ **ILT** (Deep recurrent meningeal art)

OA (ethmoidal arts) ↔ **MMA** (frontal branch)
↔ **ACA** (fronto-orbital art)

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Dangerous anastomosis of the anterior skull base

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Val D'Isère 2019

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