Vascular Tumors at the Foramen Magnum:

Endovascular and Microsurgical Management

Laligam N. Sekhar, MD, FACS, FAANS
Professor and Vice Chairman
Department of Neurological Surgery
University of Washington
Seattle, USA

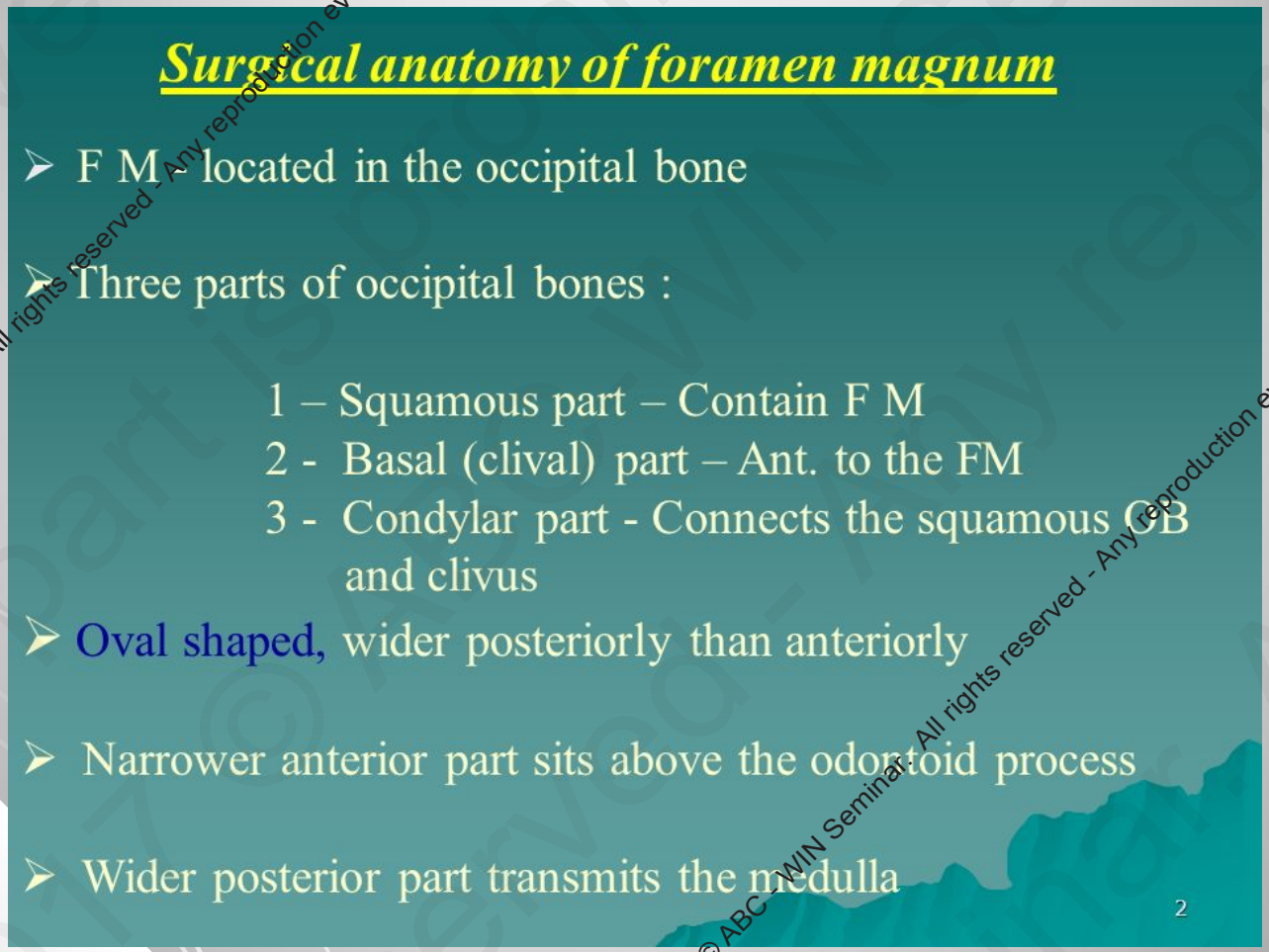
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Co Authors

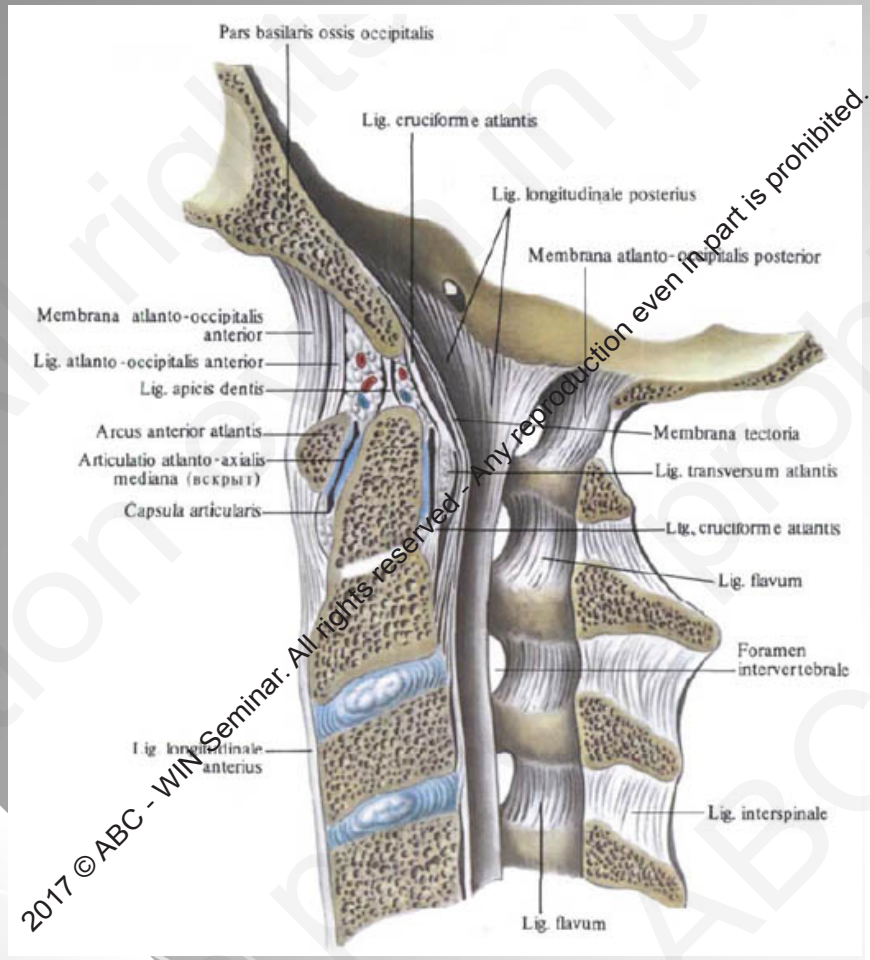
- Rakshith Shetty, MD
- Josh Abeccasis, MD
- Basavaraj Ghodke, MD

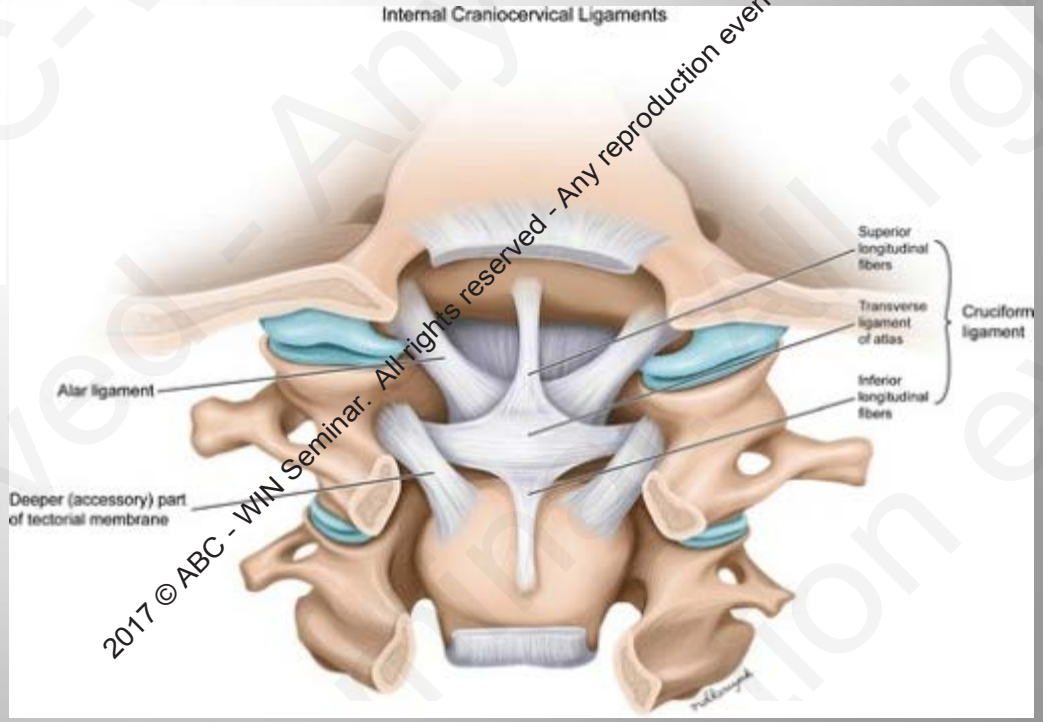
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

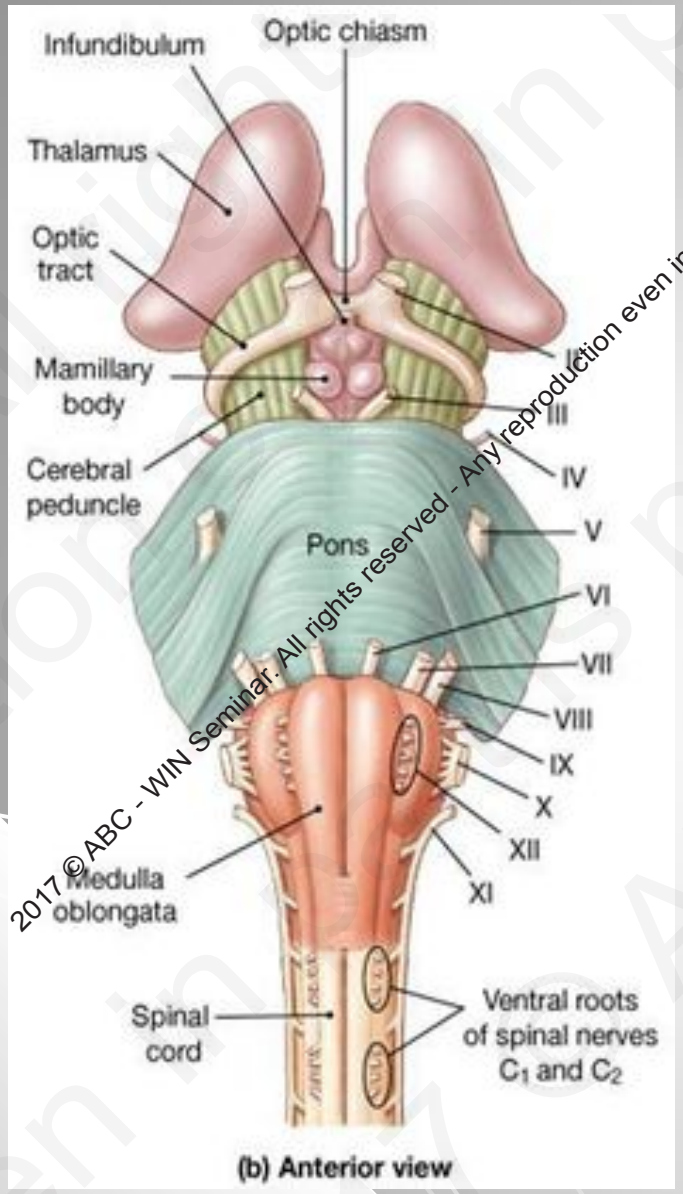
Anatomy of the Foramen Magnum Area



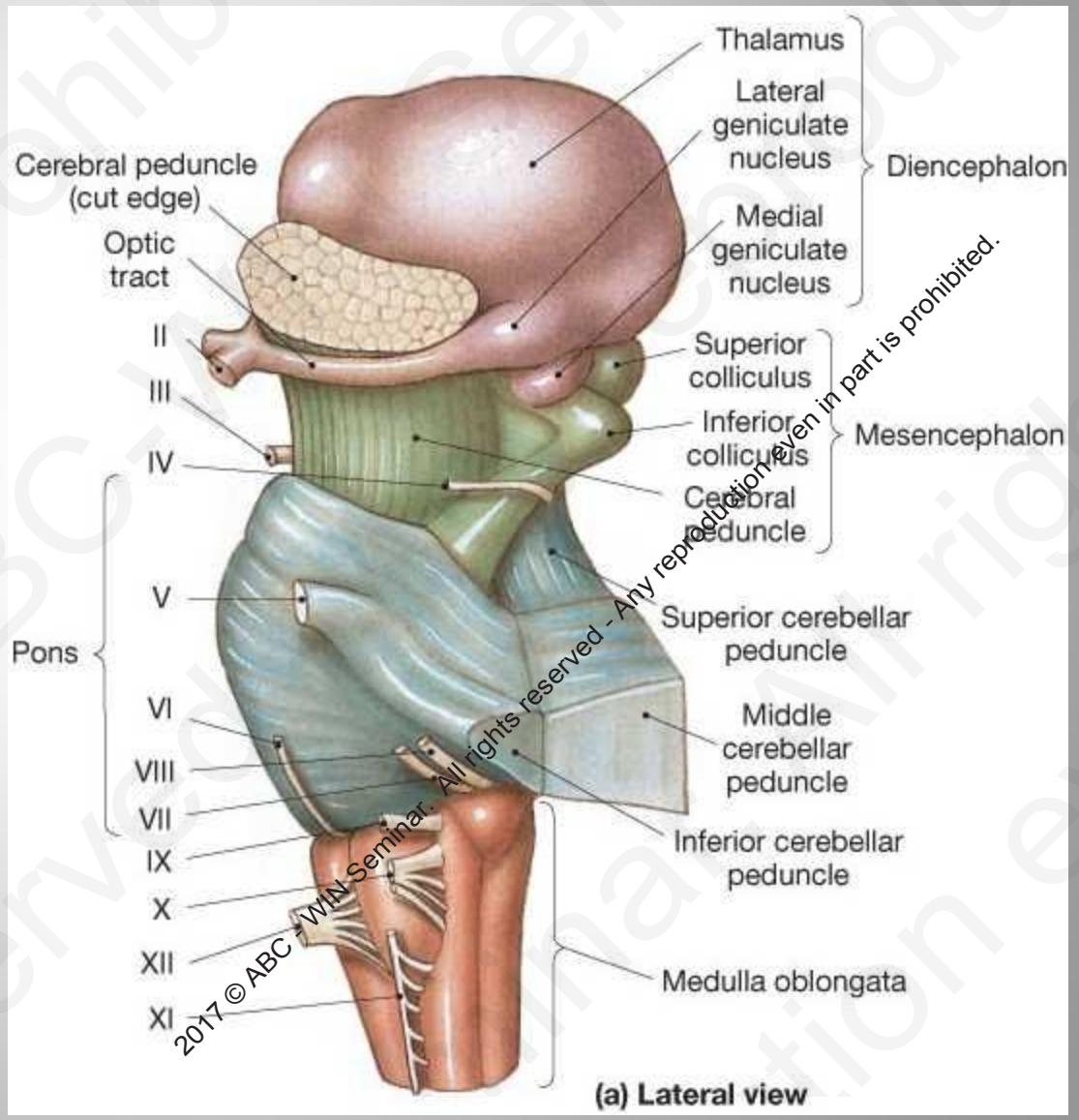
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.







(b) Anterior view



(a) Lateral view

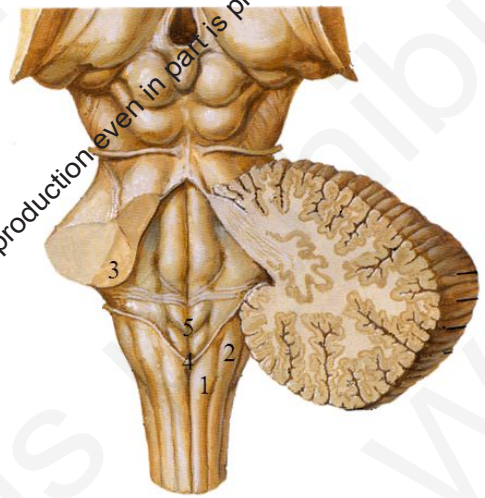
Medulla oblongata

Dorsal surface

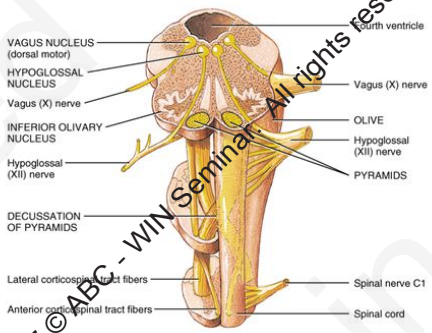
Lower portion

- **Gracile tubercle**: produced by underlying gracile nucleus
- **Cuneate tubercle**: marks the site of cuneate nucleus
- **Inferior cerebellar peduncle**
- **Obex**

Upper portion: forms the lower half of rhomboid fossa

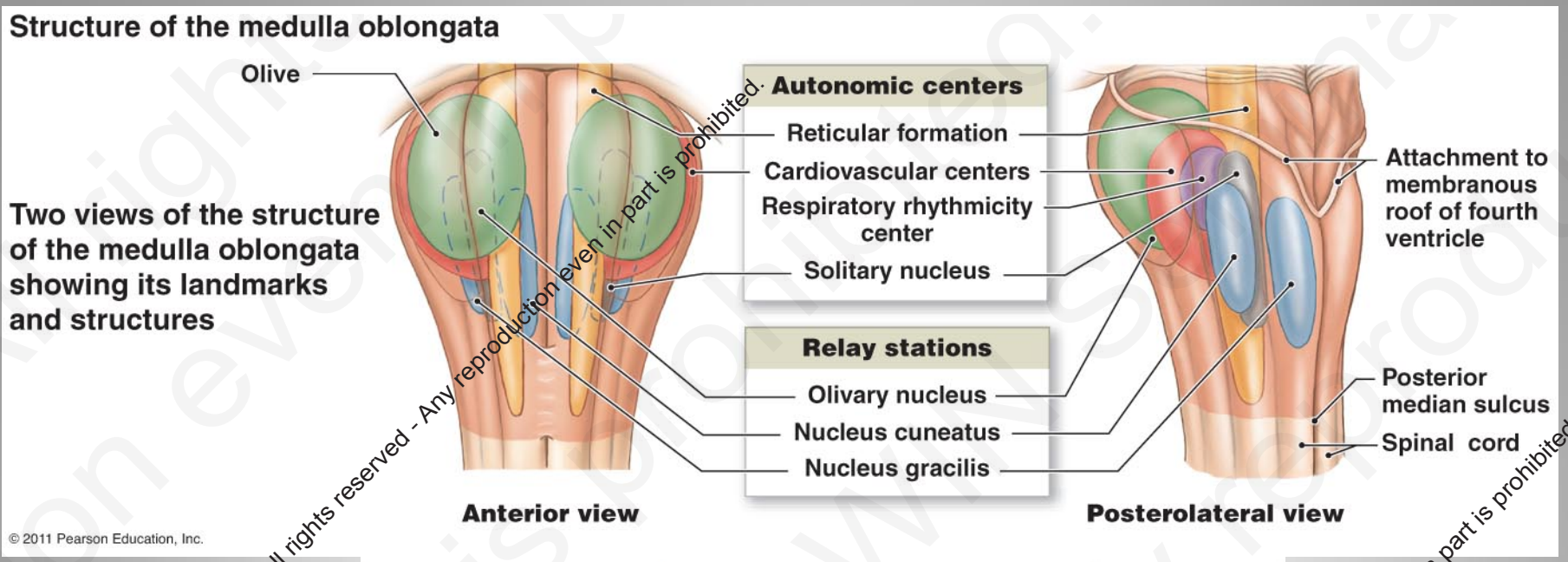


Ventral Surface of Medulla Oblongata

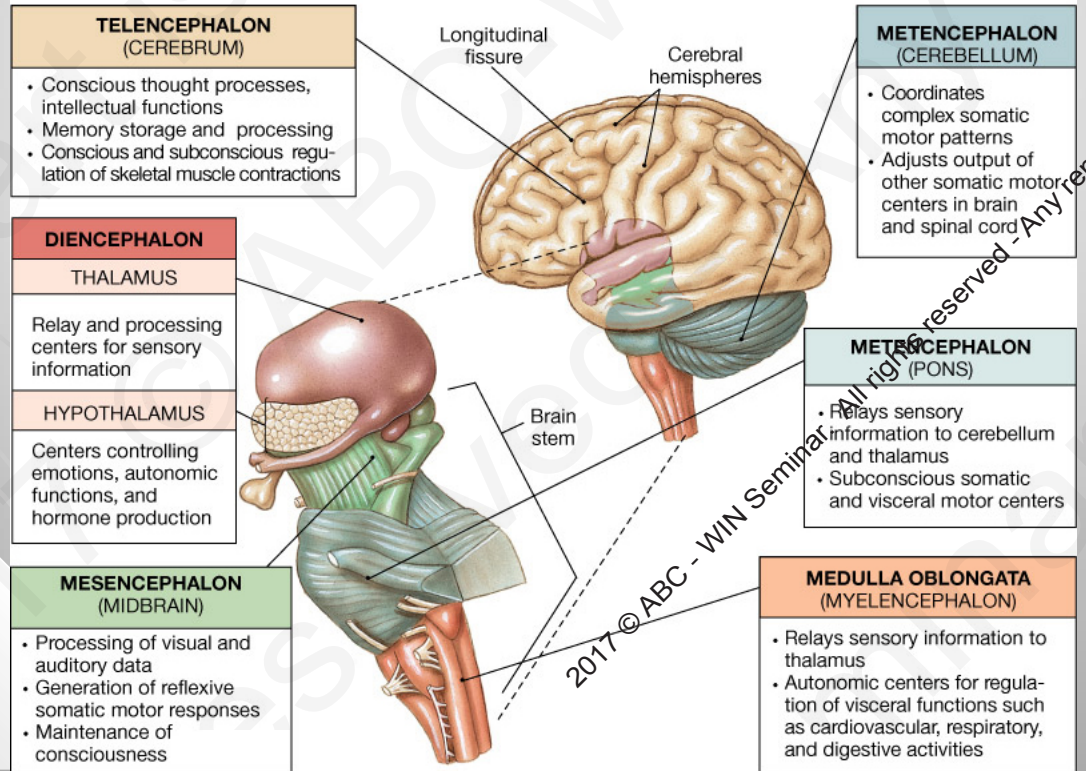


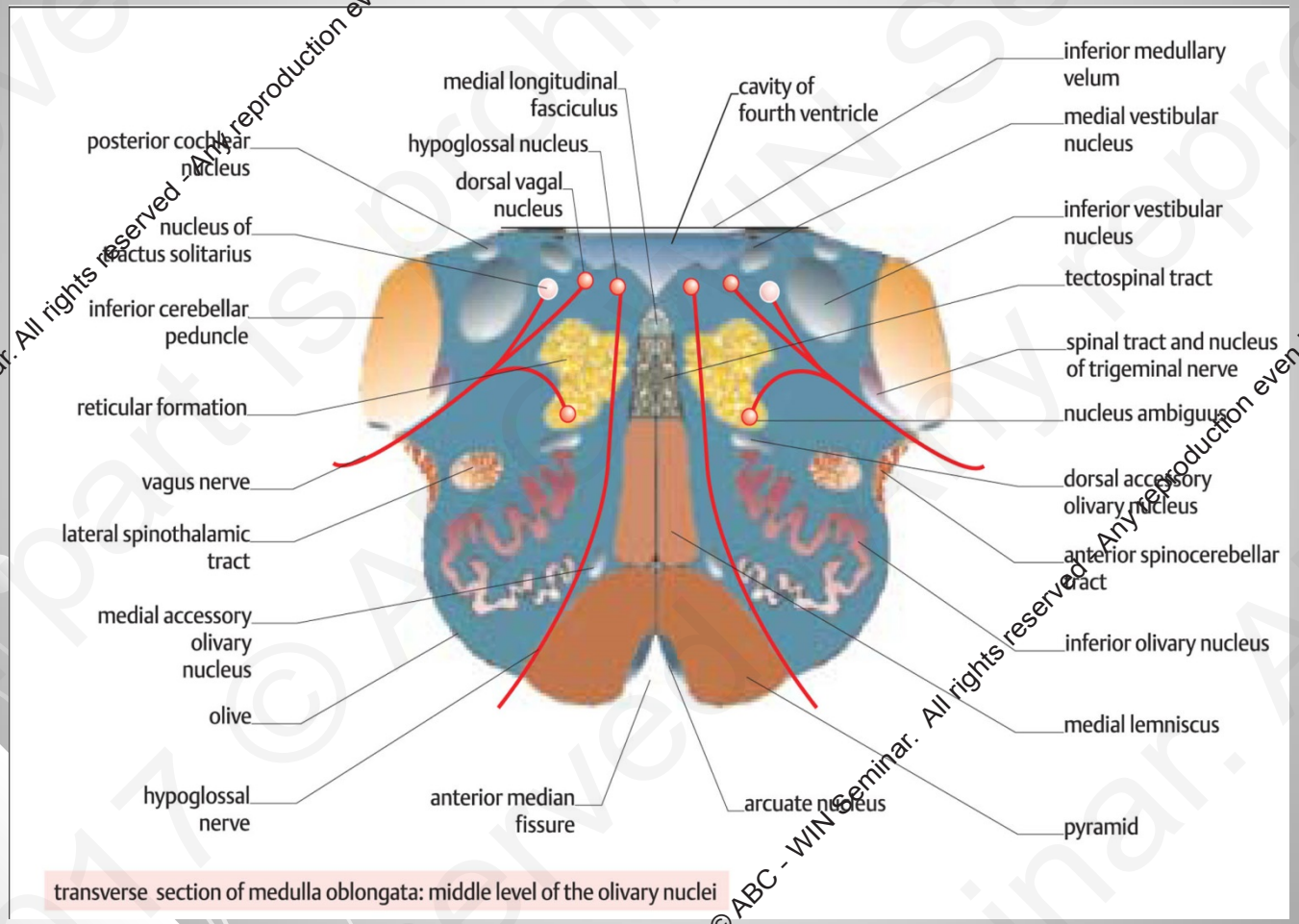
- Ventral surface bulge
  - pyramids
  - large motor tract
  - decussation of most fibers
    - left cortex controls right muscles

Structure of the medulla oblongata



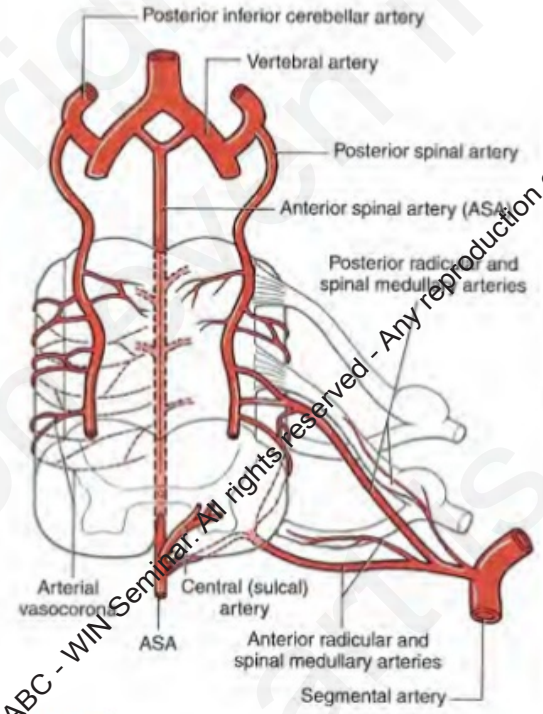
Two views of the structure of the medulla oblongata showing its landmarks and structures

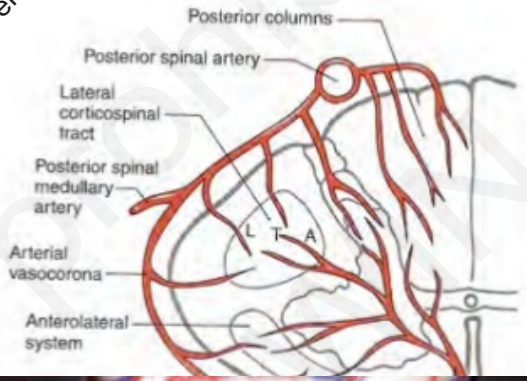




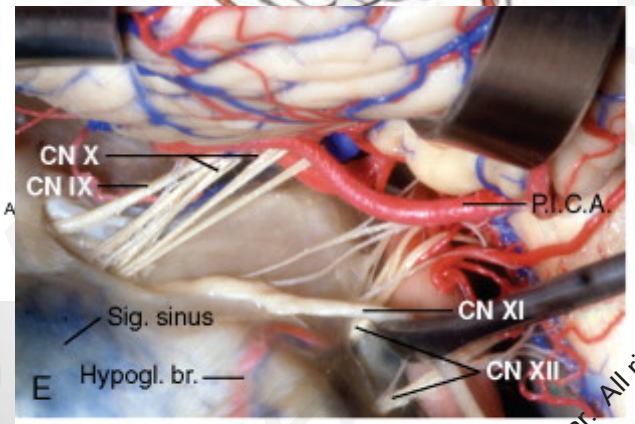
transverse section of medulla oblongata: middle level of the olivary nuclei

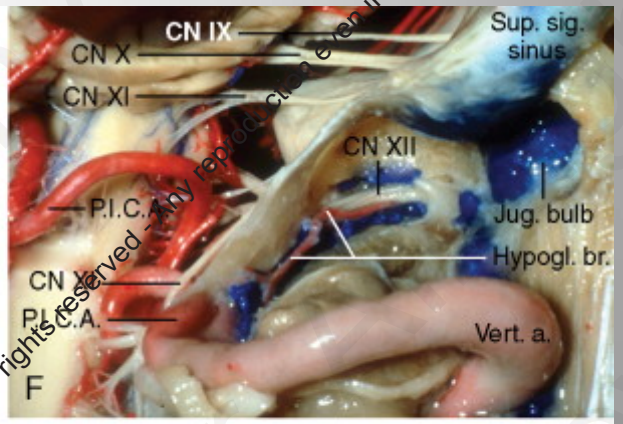
BLOOD SUPPLY OF SPINAL CORD

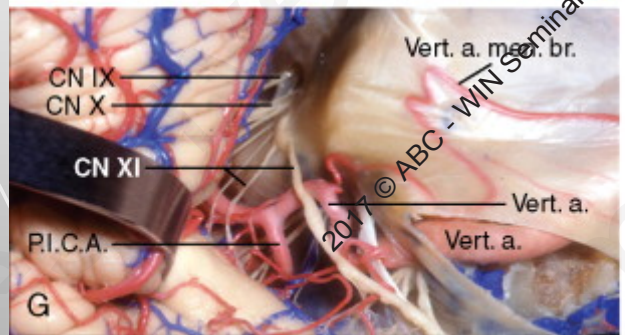


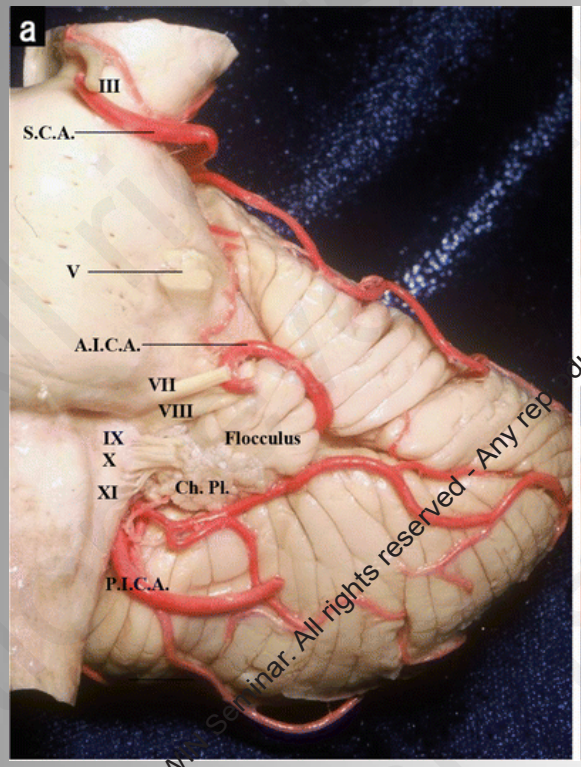


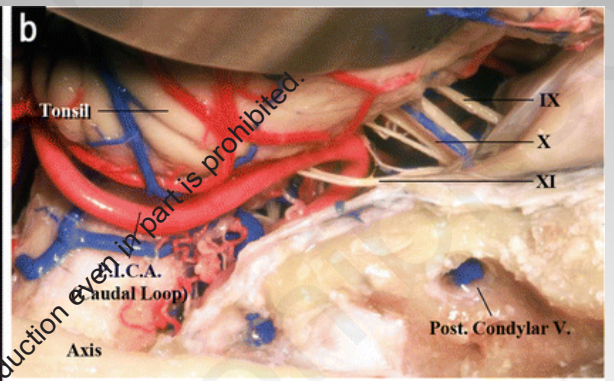
Haines, Fundamental Neuroscience for Basic and Clinical A

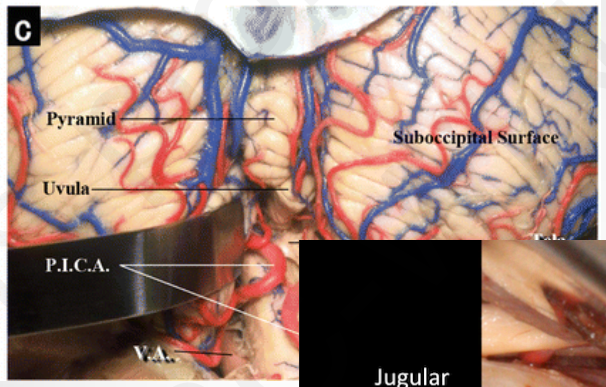


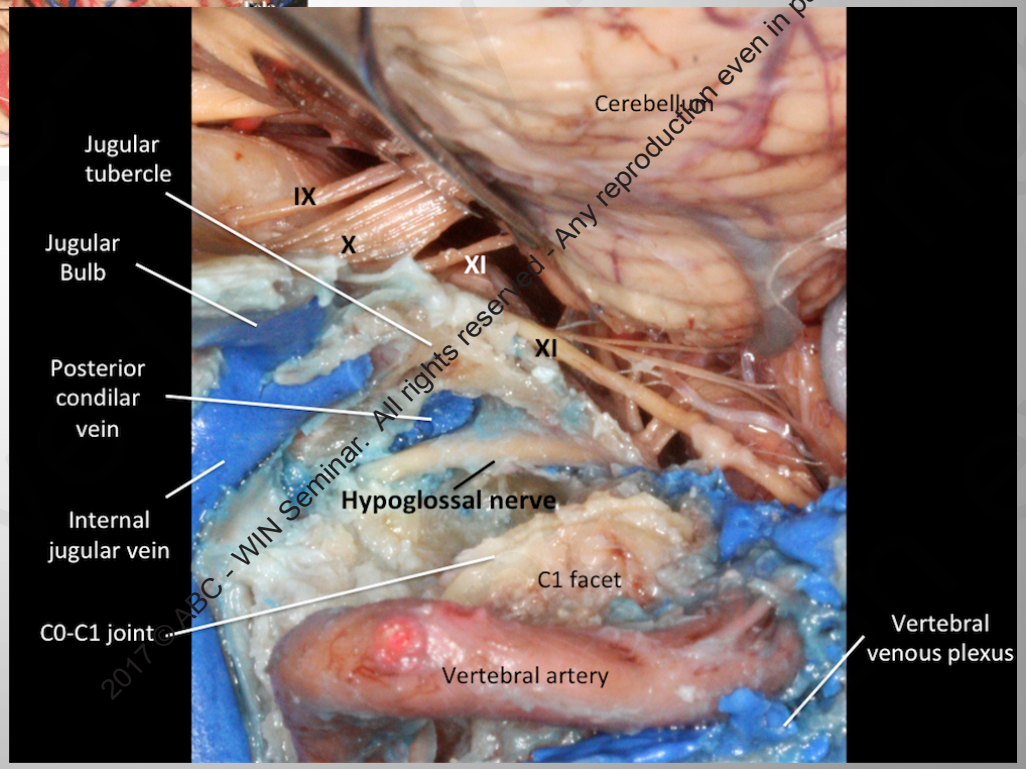


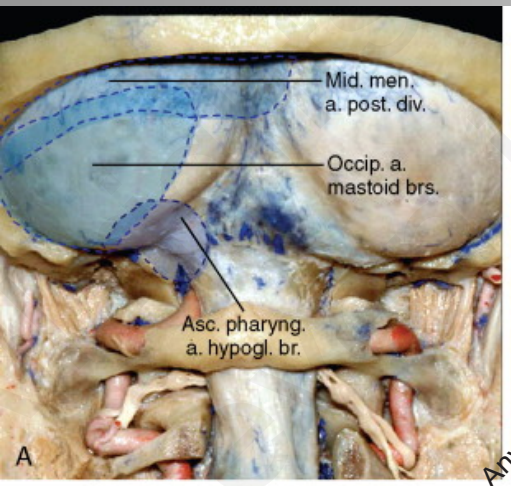


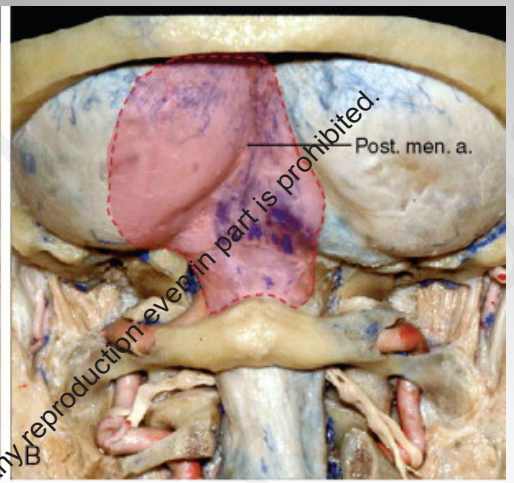


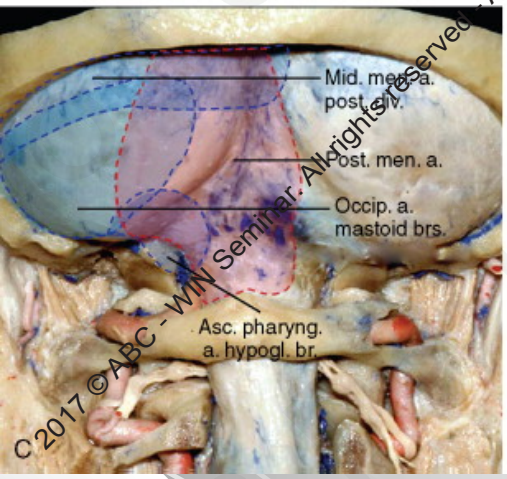


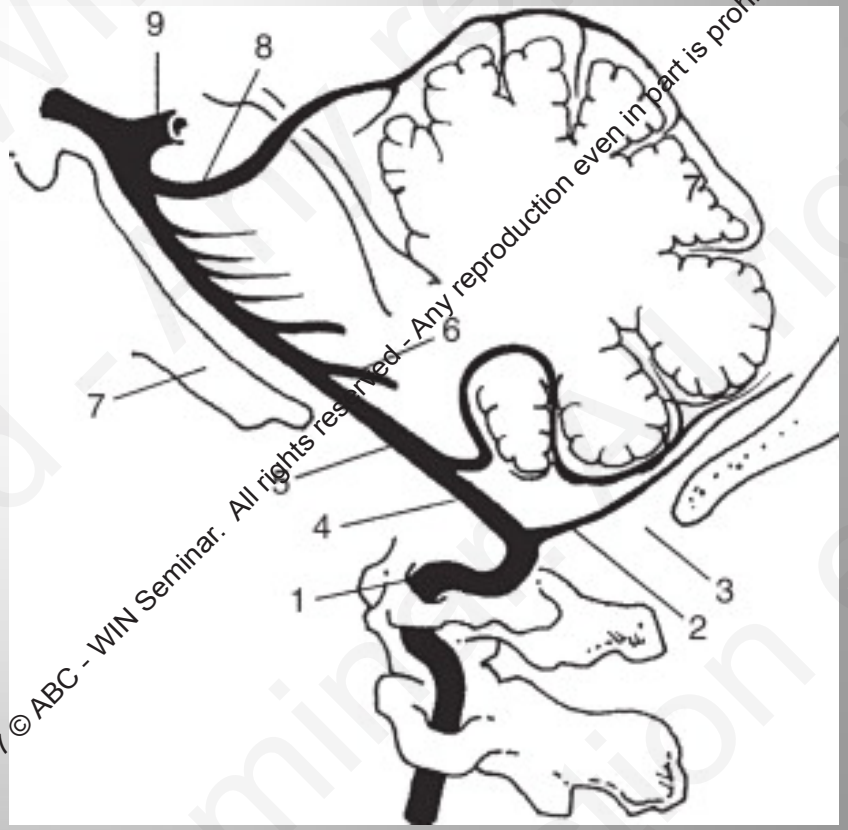












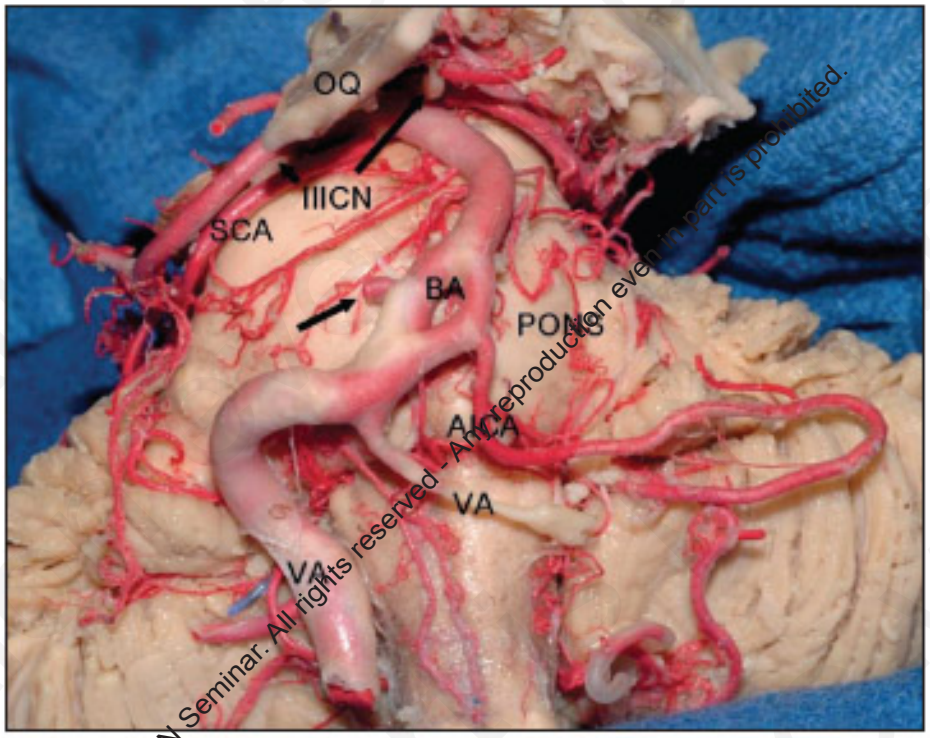
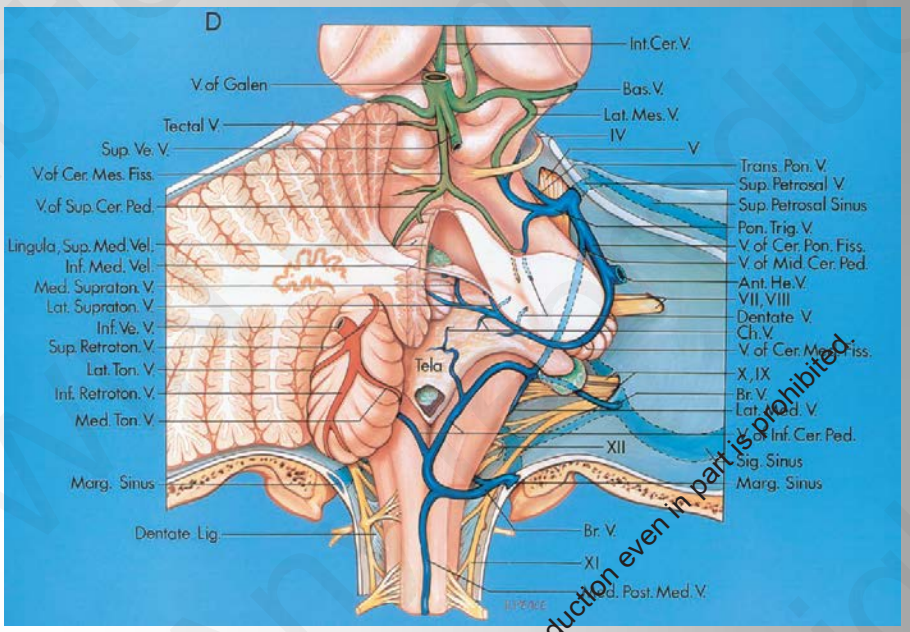
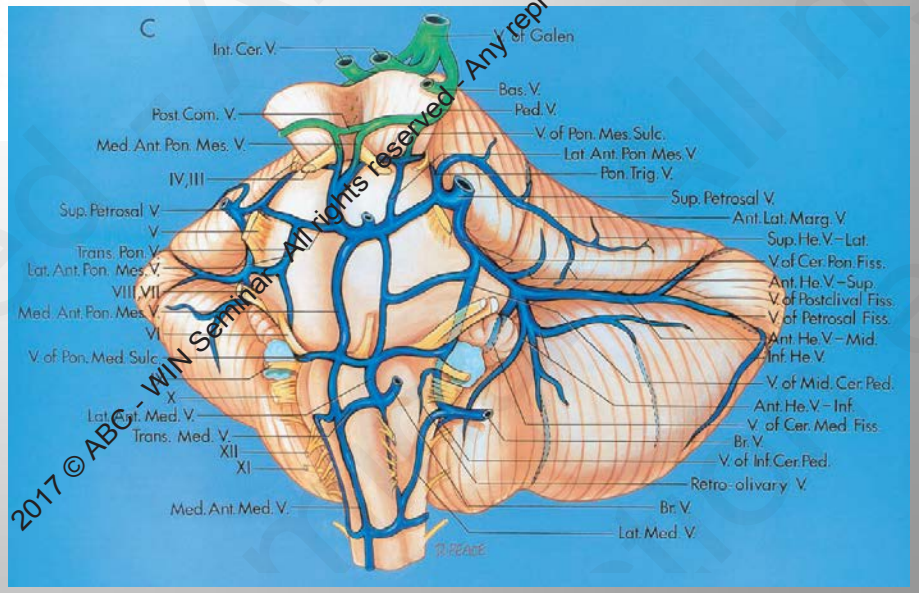
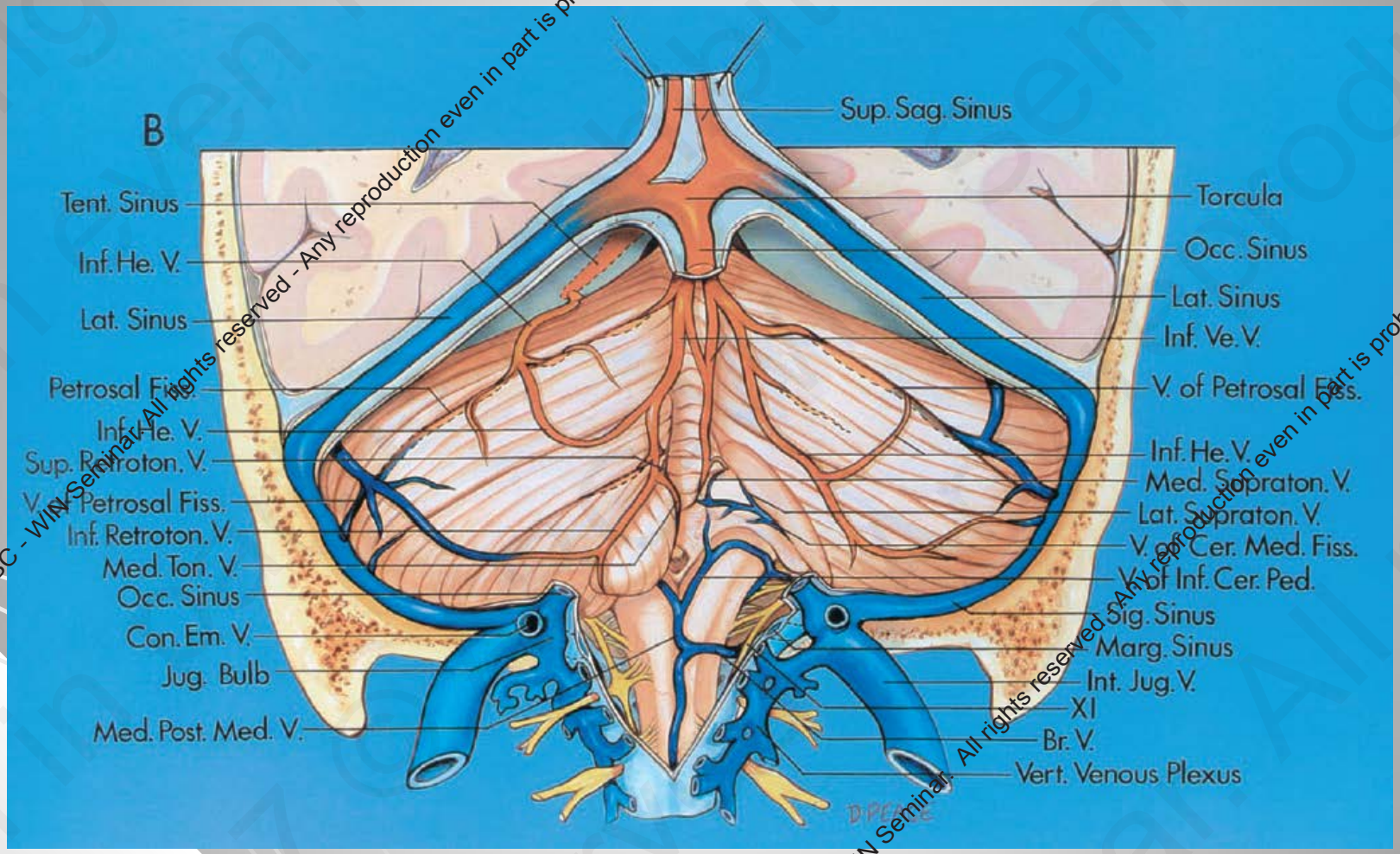


Figure 9. Anterior view of the brainstem showing the posterior fossa vasculanization. VA: vertebral artery; BA: basilar artery (with fenestration); AICA: anterior inferior cerebellar artery; IIICN: oculomotor nerve; SCA: superior cerebellar artery; OQ: optic chiasm.

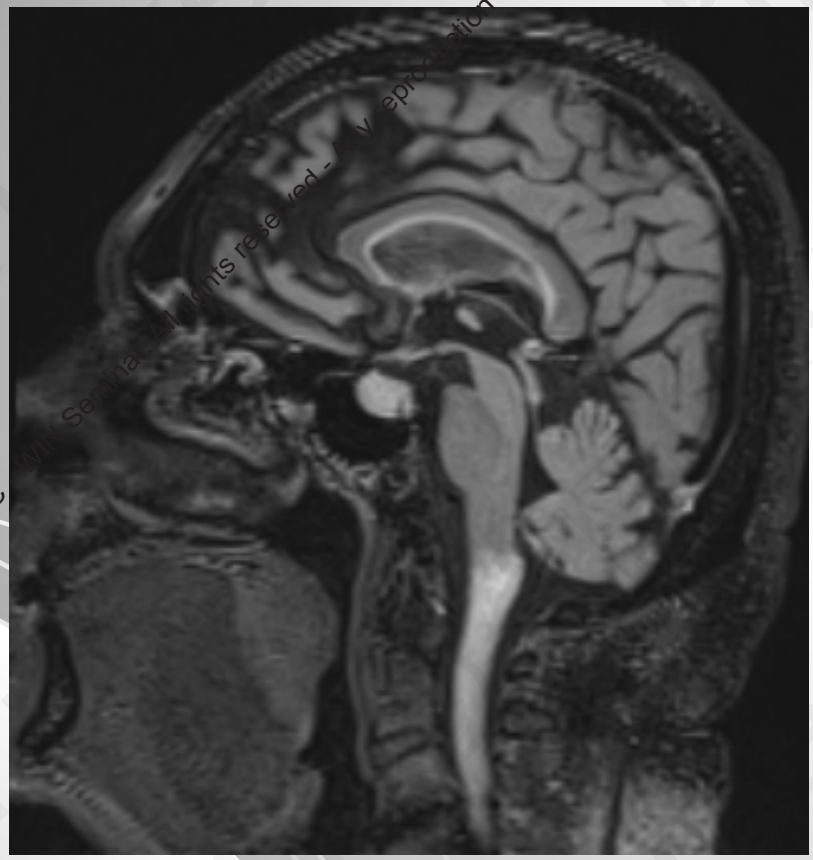


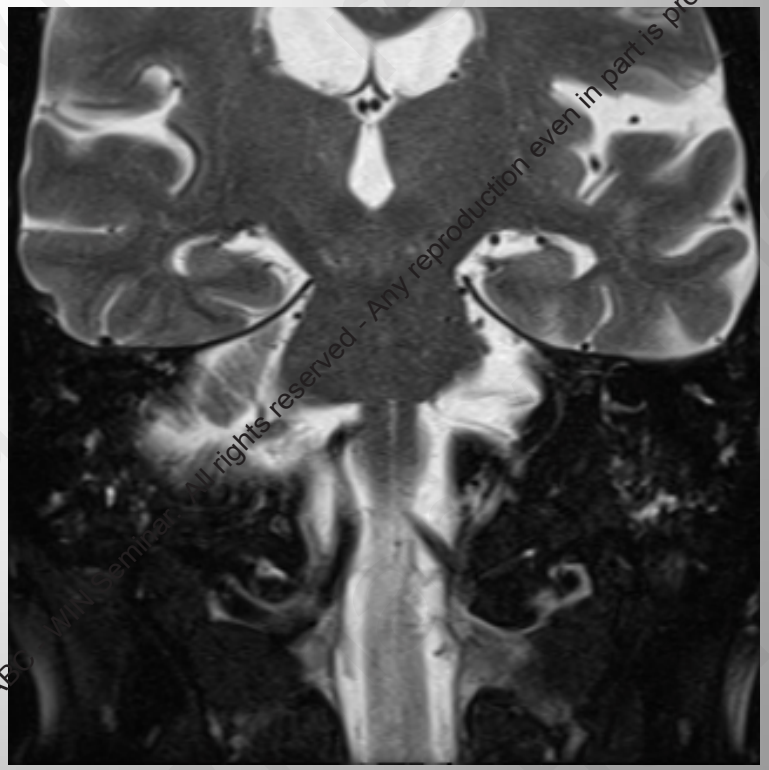


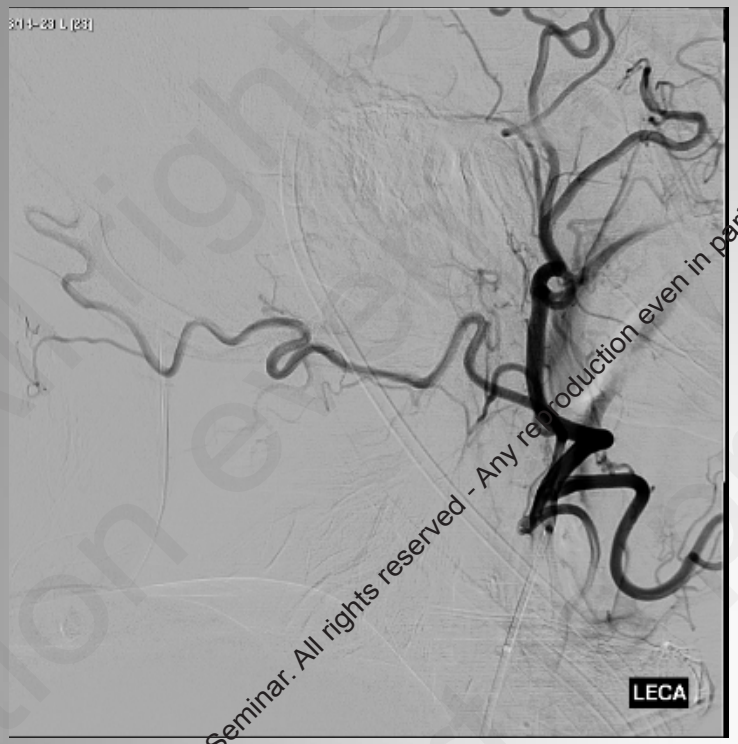


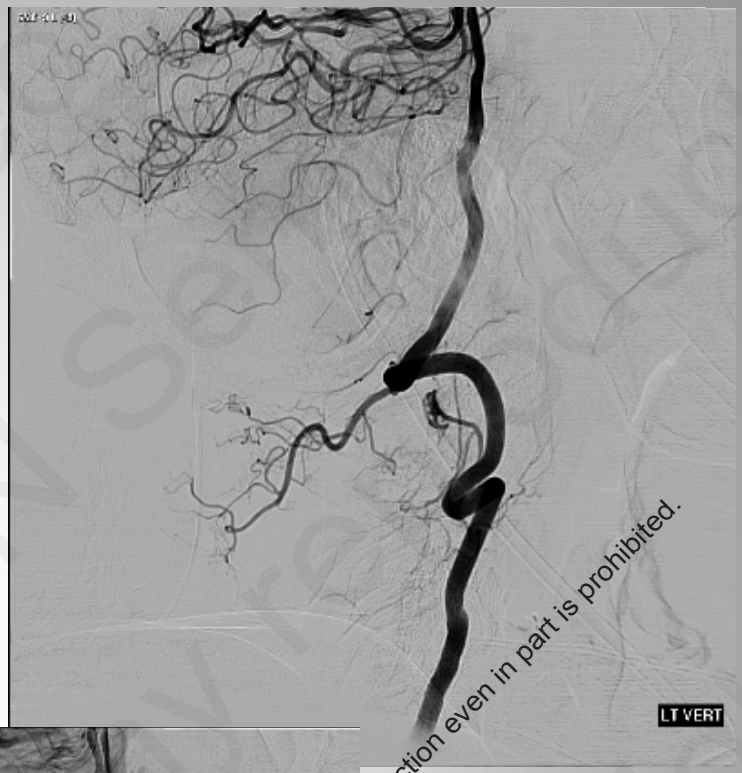
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Vanvliet

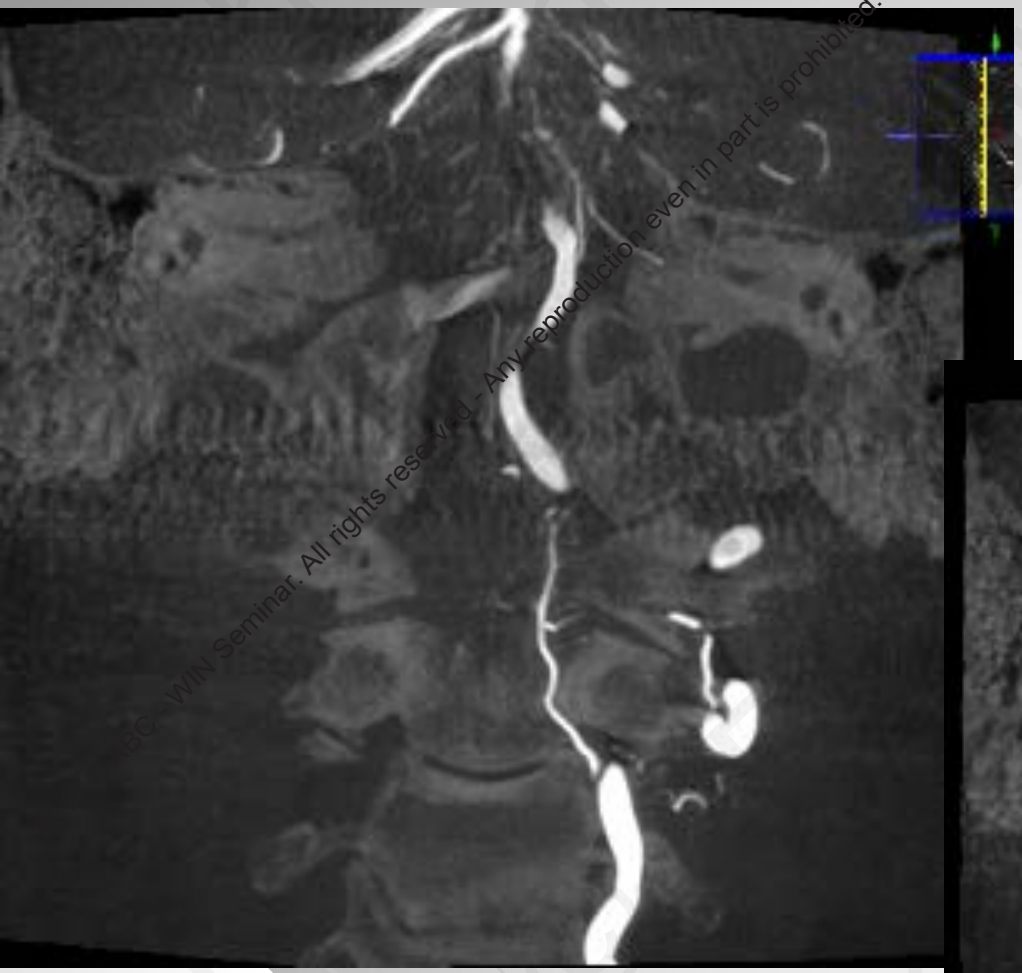


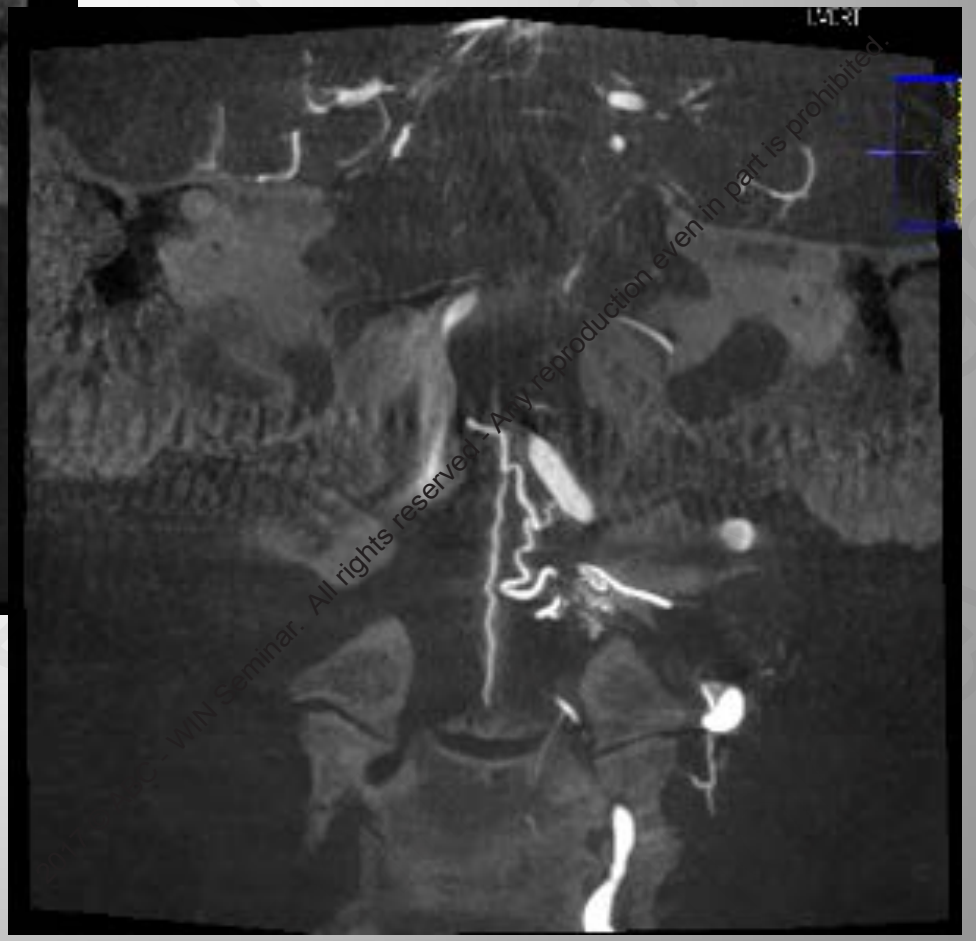




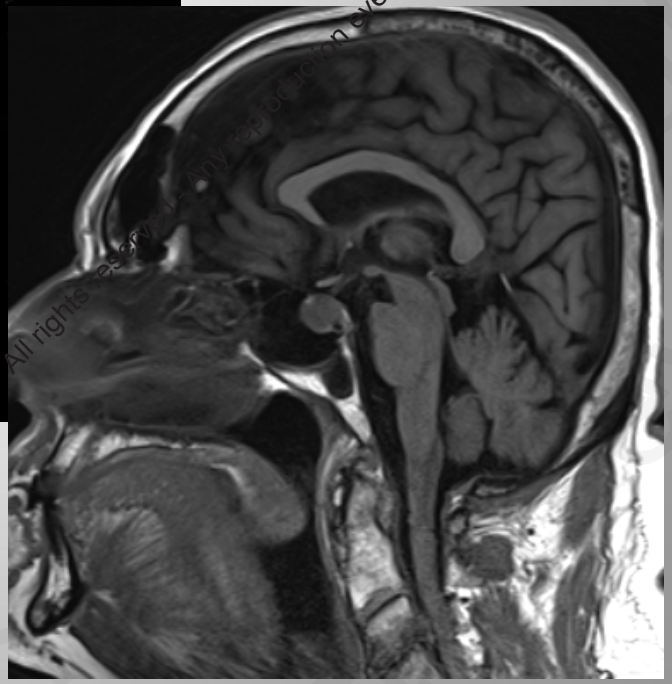


Right VA





Postoperative Studies

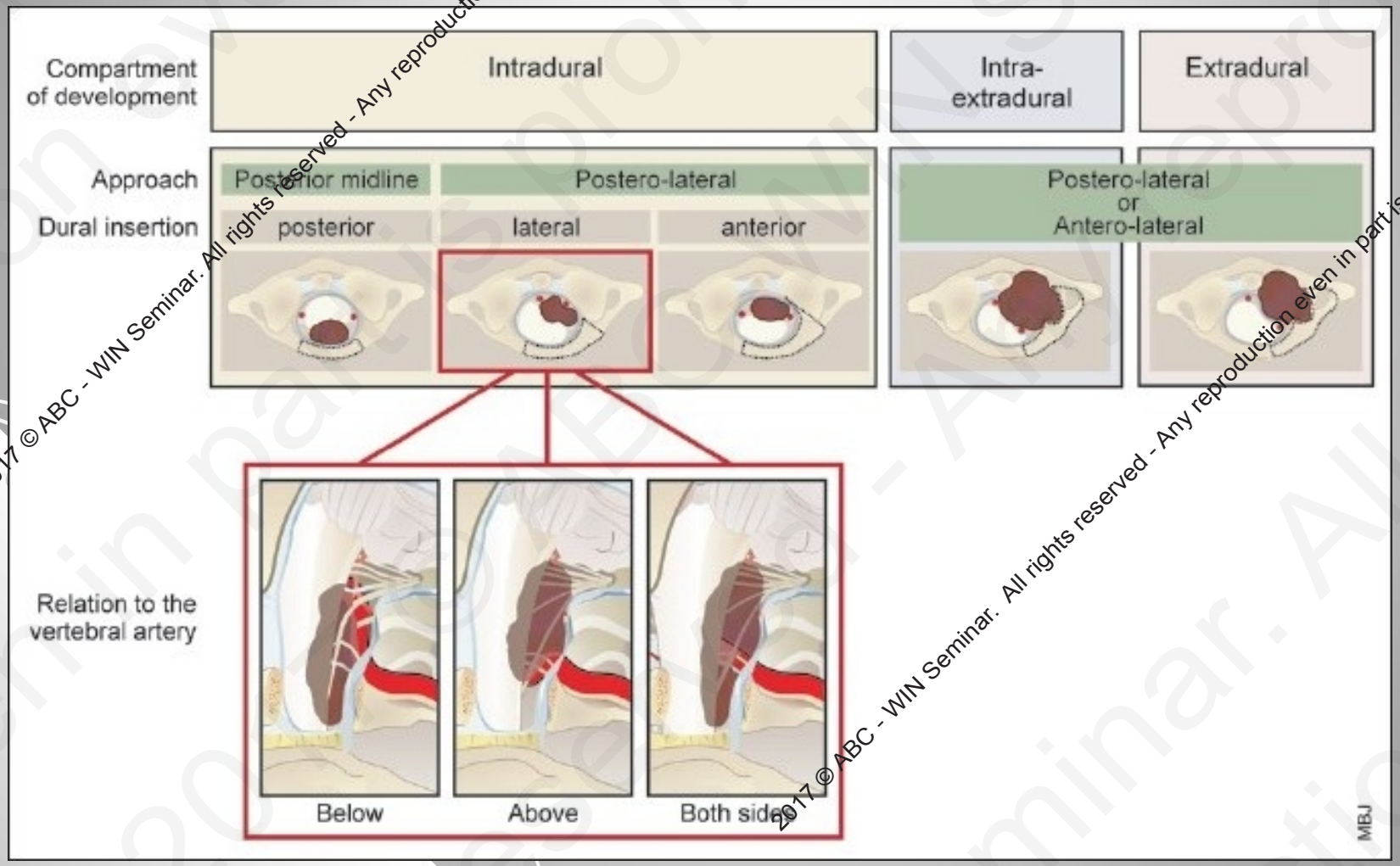


Vascular Tumors of the CV Junction

- **Mostly Intradural:**
  - > Meningioma
  - > Schwannoma (CN XII)
  - > Hemangioblastoma
  - > Metastatic Tumors
- **Mostly Extradural:**
  - > Chordoma (rarely vascular)

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Tumors According to the Location of Development, and Relationship to the Vertebral Artery



2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Angiographic Work Up

- Not Needed for small tumors with well defined vascular anatomy by MRI /MRA
- Vertebral Artery:
  - > Size, Dominance and Collateral Circulation;
  - > ? Encasement;
  - > ?PICA ; ?Anterior Spinal Artery
- Venous System:
  - > Sigmoid sinus/ Jugular Bulb?
  - > If occluded, collateral Circulation?

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Endovascular Embolization:
Helpful when Near Complete

- **ECA Branches:**

  > Ascending Pharyngeal Artery :

use large Polyvinyl Alcohol particles 250 to 350 microns

  > Occipital Artery branches- watch for anastomosis with the VA

  > **Vertebral Artery Branches:**

  > Rarely Embolizable: High risk of reflux; often, multiple small branches

  > Onyx®, or nBCA may be used

  > We have only used particles

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Foramen Magnum Meningioma: Types

- *Superior - Inferior Extension:*
  - > Predominantly above the FM (Lower clival)
  - > At the FM to C1-2
  - > Below the Foramen Magnum (down to C3)
- Lateral Extension:
  - > Mainly Lateral
  - > Anterolateral (majority)
  - > Mainly Anterior (rare)
- Consistency:
  - > Soft (Rare); Firm and fibrous(common); Calcification
- Vascularity:
  - > High Vascularity indicates a WHO Grade 2 or 3 tumor

FM Meningioma: Risk Factors

- *Size :* Small < 2cm; Medium 2 to 3.9 cm; Large ≥ 4 cm
- *Arterial Encasement:* VA (one or both), PICA; Anterior Spinal Artery. Perforating Branches
- *Invasion of Major Veins:* Anterior Spinal Vein
- Spino Medullary Brain Invasion: Flare Signal on MRI ±
- Cranial Nerves : 9 -11; 12
- Prior Surgery or Radiotherapy
- Hydrocephalus
- Tumor Consistency and Vascularity

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Preoperative Work Up

- Audiogram
- Voice and Swallowing Evaluation
- MRI Scan
- CT with bone Windows
- Angiography for large and artery encasing lesions
  - VA, Sinuses, Jugular bulb, collaterals
- MRA and MRV for smaller lesions
- Embolization (PVA) for vascular lesions

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Anesthesia and Monitoring

- Total Intravenous Anesthesia
- Cranial Nerves 7,8,10, 11,12
- SSEPs
- MEPs

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Operative Approach

- Tumors are Rarely Posterior to the Cord
- Antero- lateral or Anterior location
- So, the Approach:

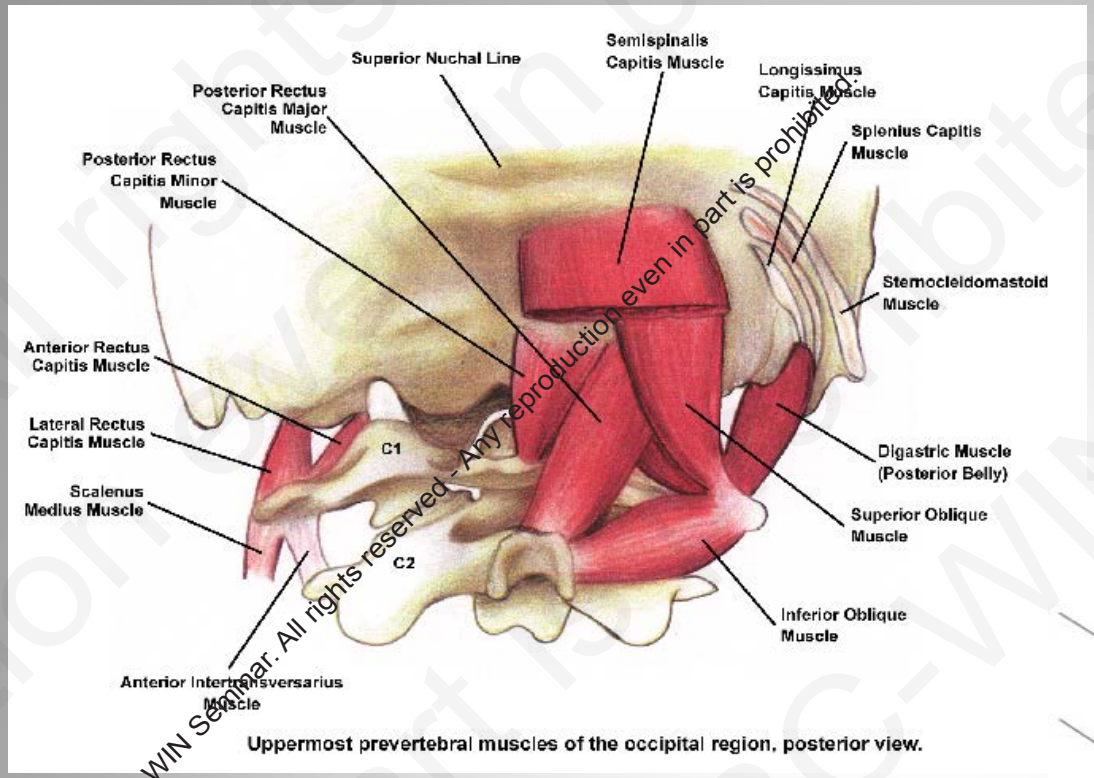
  > Postero- Lateral: (Extreme Lateral, Retro condylar)

  > Lateral: (Extreme Lateral, Partial Trans condylar); Occipito- cervical fusion Rarely needed

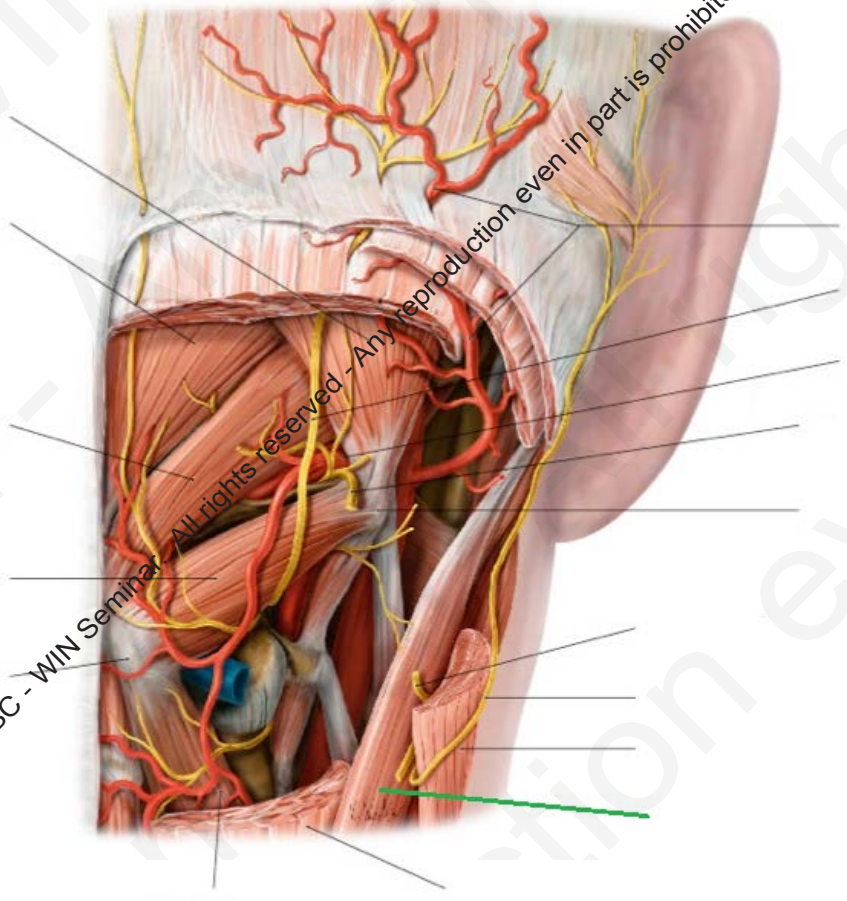
  > Anterior Approach (Trans Oral): Not used; High risk of CSF leak, All the relevant anatomy not exposed

ANATOMY OF MUSCLE LAYERS

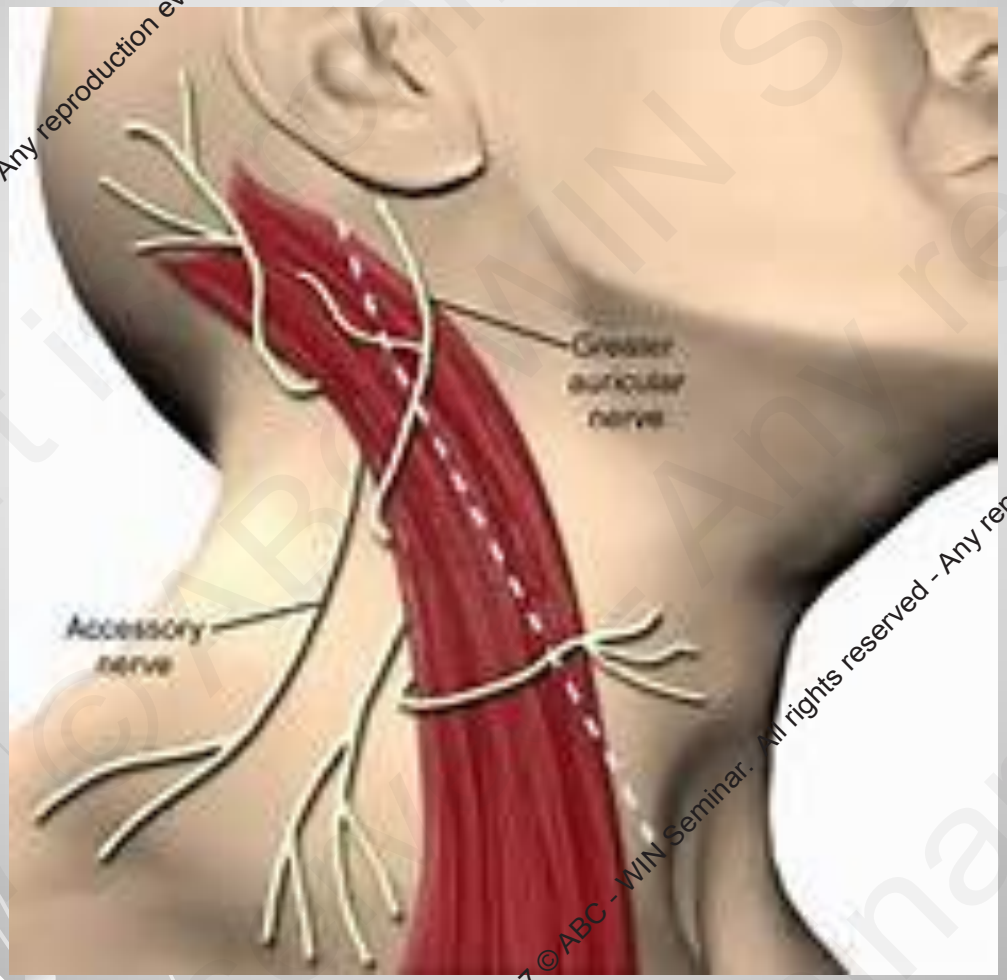
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



Uppermost prevertebral muscles of the occipital region, posterior view.



Spinal Accessory Nerve

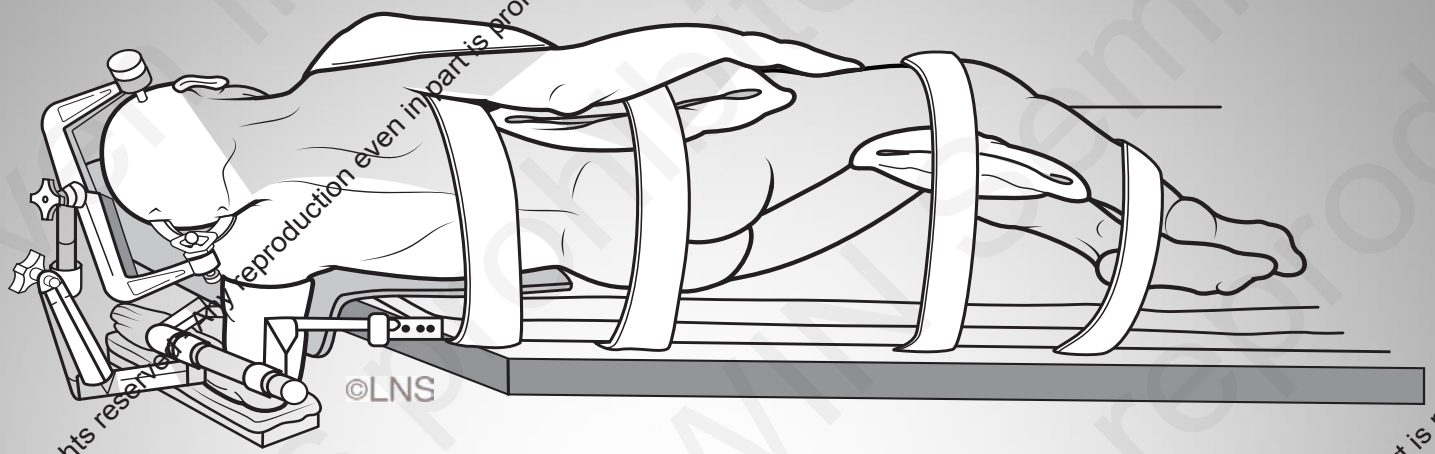


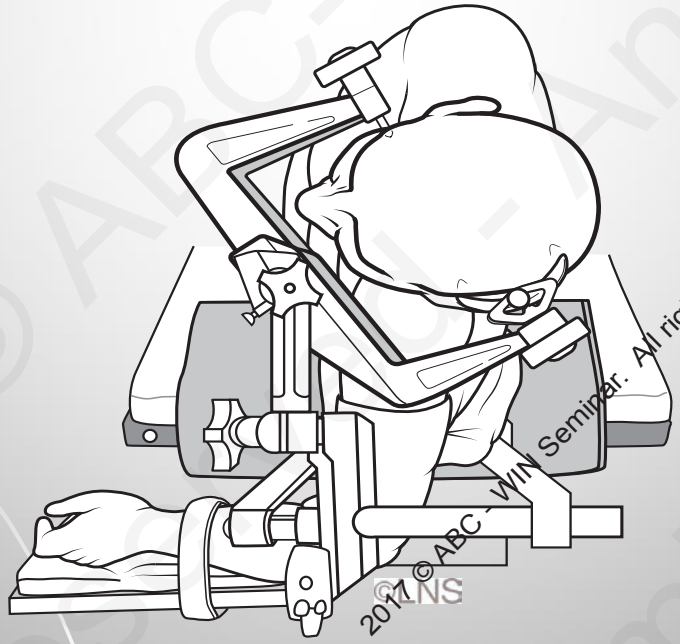
Patient Position

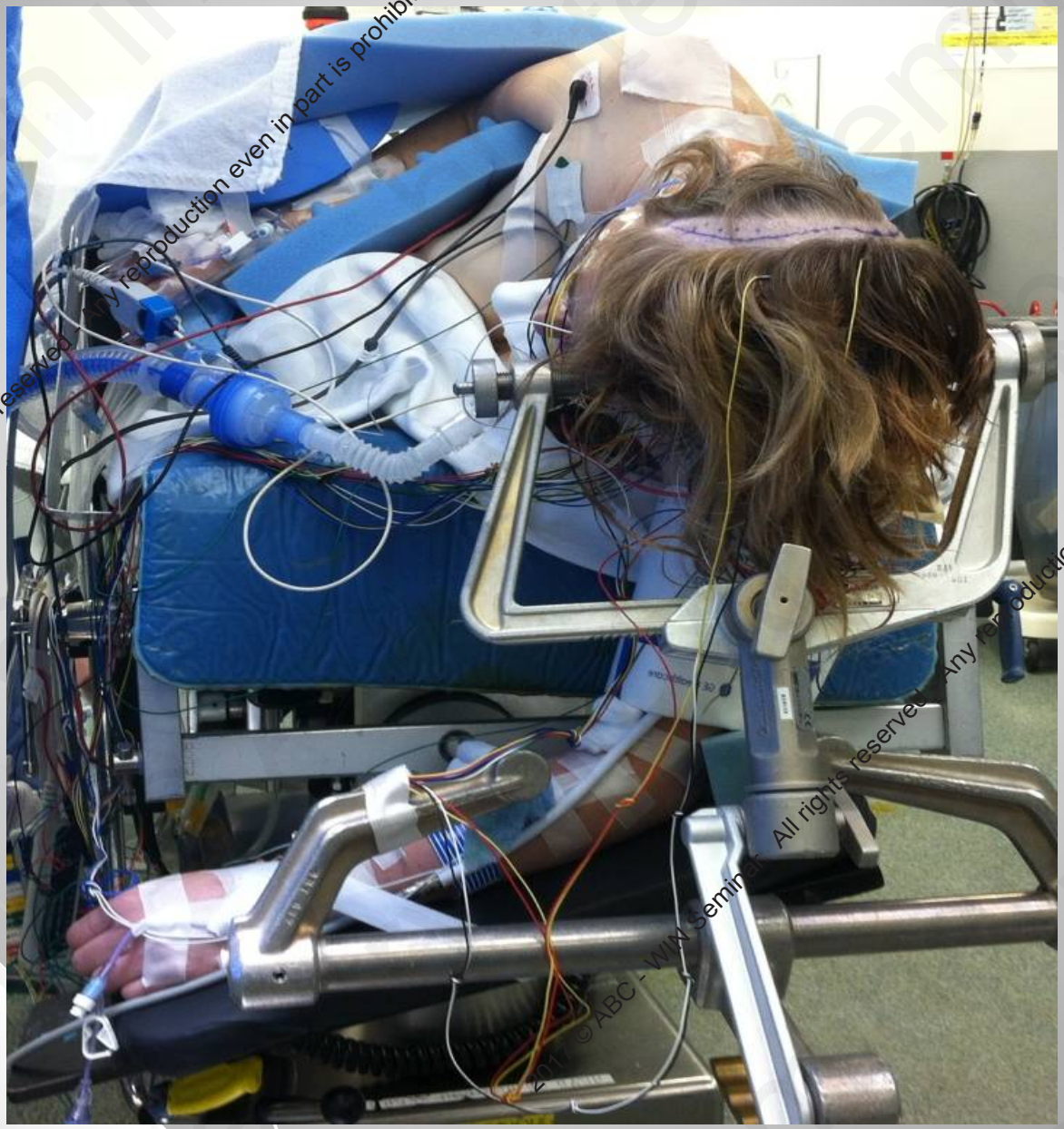
- Supine with a Roll, Head Turn -
  - > Lateral Approach Combined with Petrosal, or
  - > Need for Radial Artery/ Saphenous Vein Extraction
  - ★ C1 rotates on C2, stretches VA, may occlude it (dominant VA especially)
    - Check for excessive Neck rotation with Retrograde Jugular Bulb Pressure, Trans cranial Doppler, and MEPs
- Lateral –
  - > Better Position; less risk of VA Occlusion
  - > RAG Taken from Upper Arm or SVG from Lower Leg
  - >Intraoperative Angio can be done with insertion of Arrow Femoral Sheath

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Preferred Position: Lateral





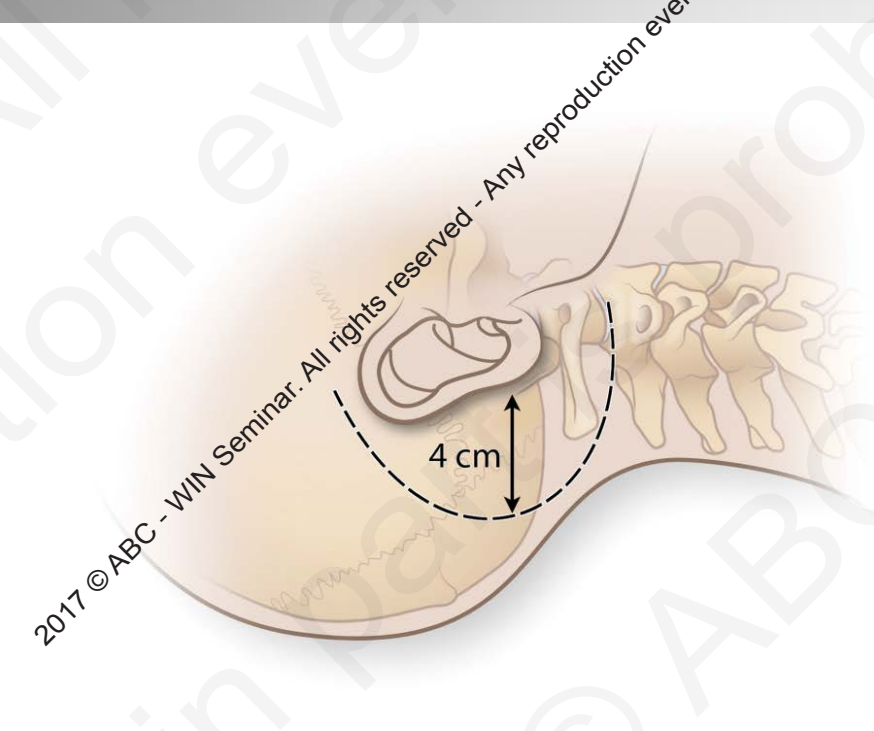


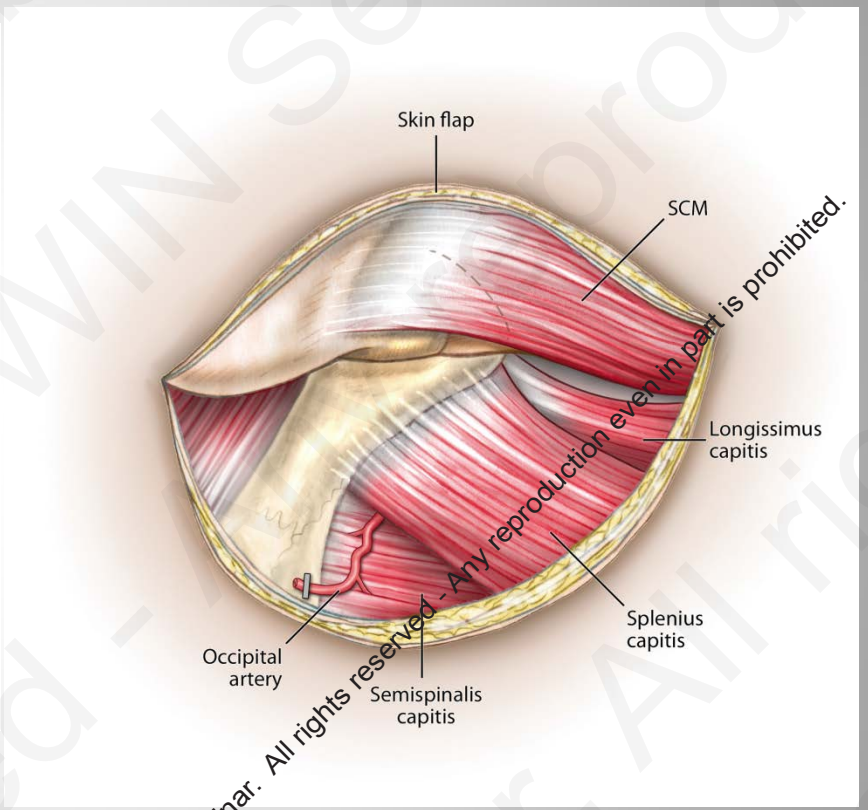
Incision and First Layer

- A C- shaped Incision is preferred to an inverted U-shaped incision
- Skin elevation usually with the SCM
- SCM can be separately reflected inferiorly for lesions lower than C2
- Below C2, Spinal XI crosses from SCM to Trapezius, needs to be identified and preserved

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

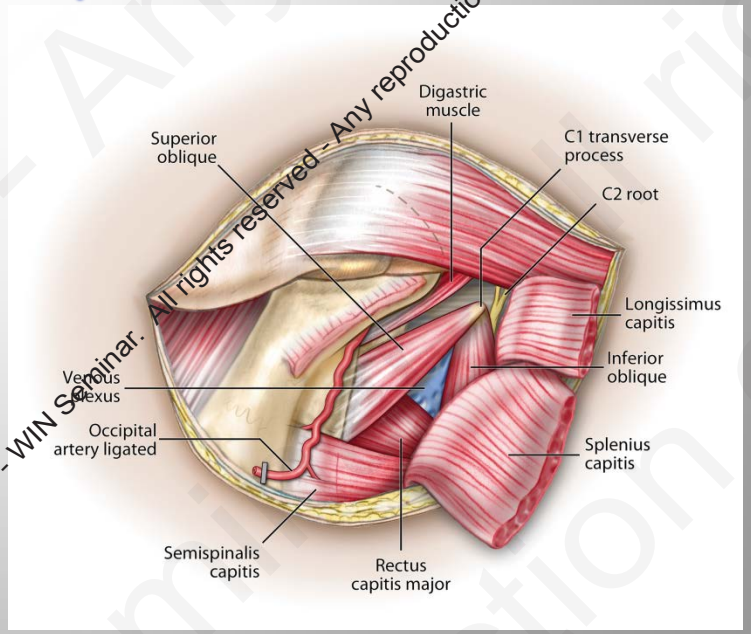
Incision and First Layer





Second And Third Layer

- Second Layer: Splenius Capitis Reflected Posteriorly
- Third Layer: Semispinalis Capitis, and Longissimus Capitis Reflected Inferiorly
- Landmarks : Mastoid Tip, and C1 Transverse Process are Important Landmarks ; Are Palpated Now



Second and Third Layer Off

Fourth Layer

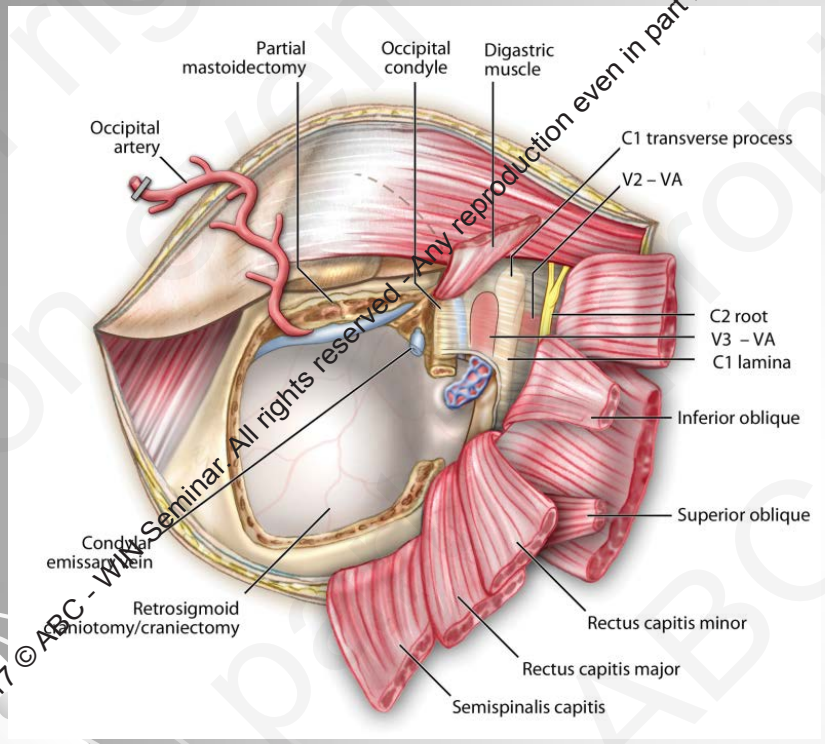
- Superior and Inferior Oblique cut and reflected medially from C1 Transverse Process
- Longissimus Cervicalis may be reflected Inferiorly
- Rectus Capitis Major Elevated from Suboccipital Bone
- Lamina of C1 palpated, VA venous plexus visible
- VA identified deep to the venous plexus at C1, or between C1 and C2 (C2 nerve root)
- Venous bleeding may be controlled with bipolar cautery and fibrin glue

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

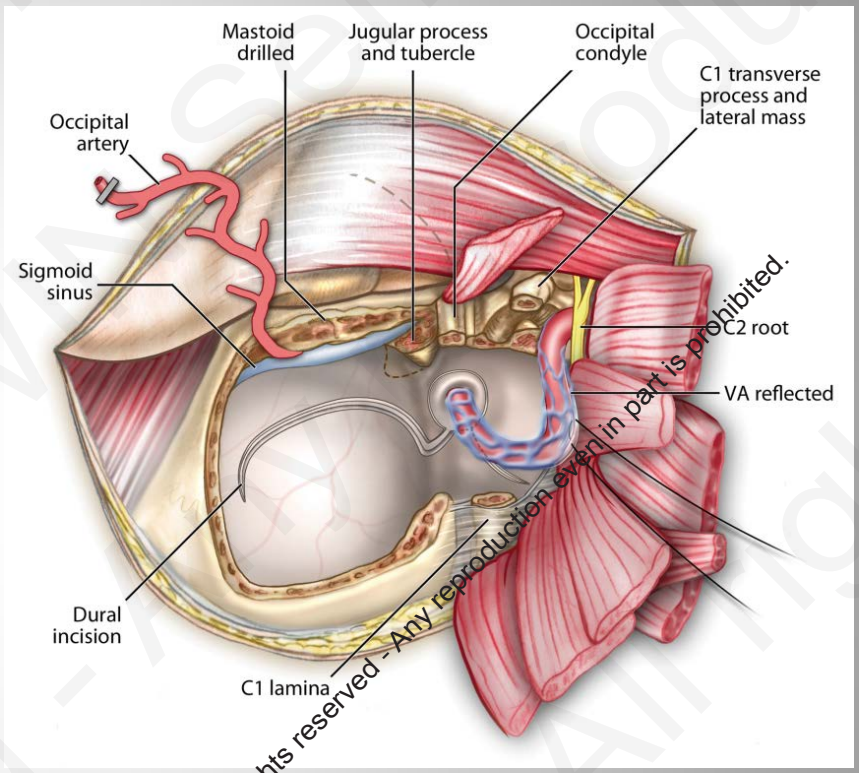
How to find the Vertebral Artery

- C1-C2 (Terminal V_2 Segment) :
  - > C2 root crosses lateral to it
  - > Longer segment, often more easily found
  - > Deep to Longissimus Cervicalis Muscle
- Superior to C1 (V_3 Segment) :
  - > Venous Plexus
  - > Sub occipital Triangle Muscles
  - > Bony Groove on C1 lamina
- Micro Doppler, Navigation (altered anatomy)

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

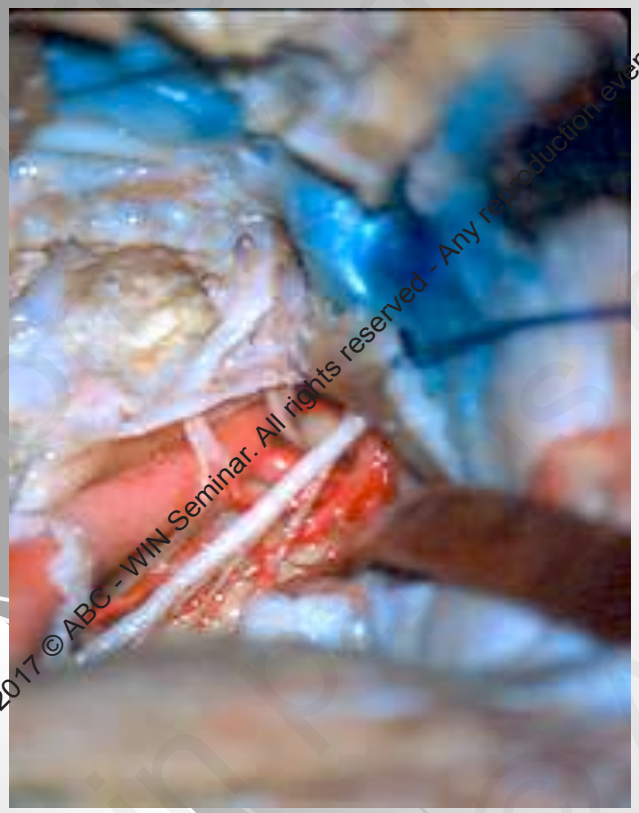


V3 Exposure; Retro condylar Approach



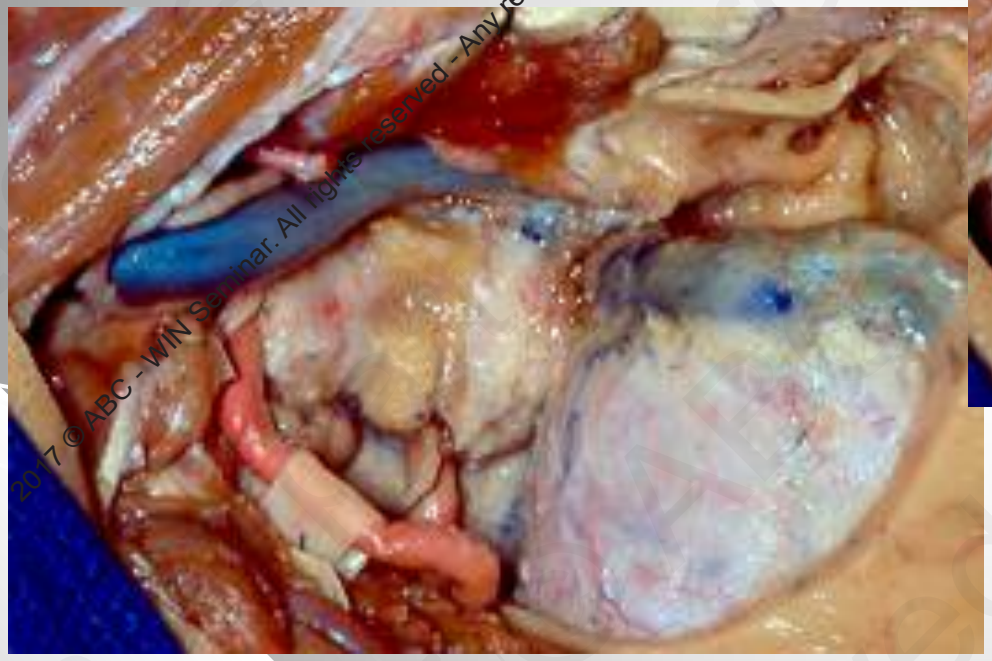
V2-3 Exposure
VA Translocated;
Partial C1-Occipital Condyle Resection In Vertical Line with Mastoid Tip

CN XI, XII, and Intradural VA



Anterior Spinal Artery

Dural Closure



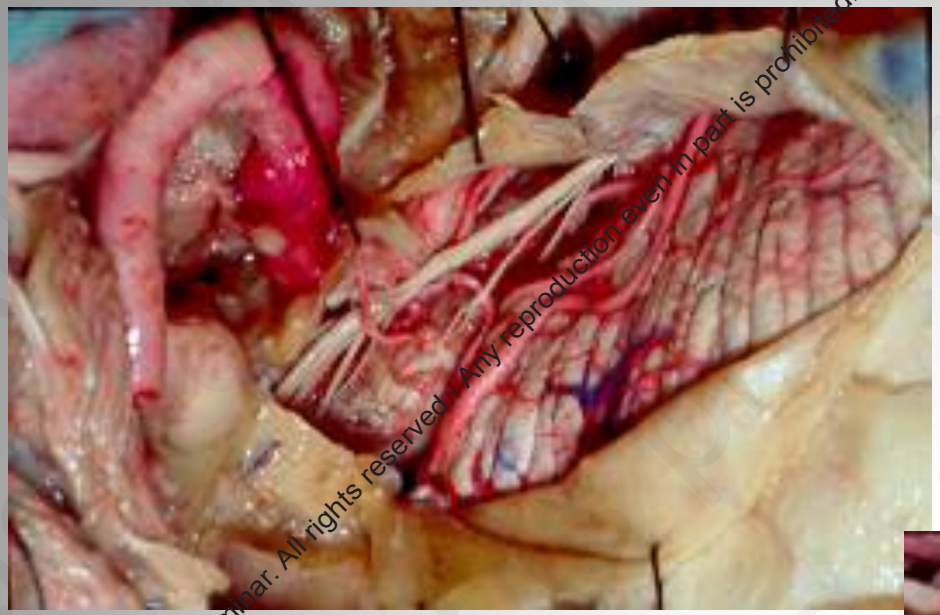
VA Translocation; Surrounding Anatomy

Dural Incision

Craniotomy and Laminectomy

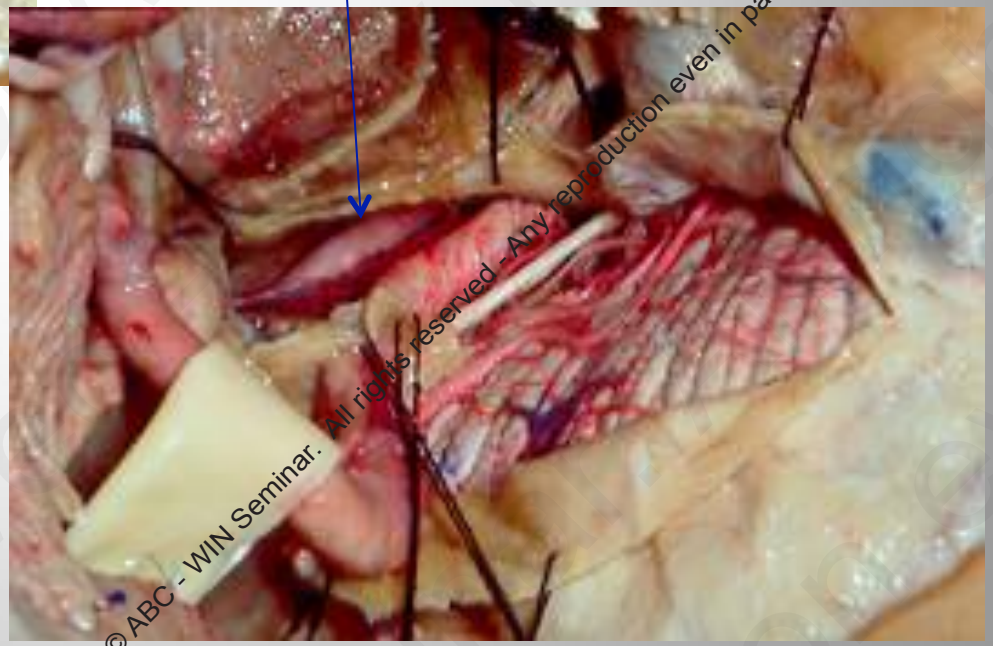
- Sub occipital Craniotomy incl. Foramen Magnum for Cranial Cases
- Mastoid Bone Drilled to expose the Medial edge of the sigmoid sinus
- CN 7 runs deep and anteriorly, can be found by finding the lateral semicircular canal, or the digastric groove ; Not Necessary to Expose it
- Lateral half laminectomy C1 to C3 for spinal and Foramen Magnum cases

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



Dural Opening;
No VA Translocation

VA Translocated;
Contralateral VA Seen



Closure

- Fascial Graft or Dural Substitute must be used to close the defect, suture circumferentially
- Suture Dural Graft to VA using the periadventitial cuff of tissue
- Fibrin Glue
- Muscles must be reapplied anatomically to allow vascularized closure
- Ventriculostomy in case of redo operations, Hydrocephalus
- May need Trapezius flap if muscles atrophic

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Foramen Magnum Meningioma: Why Do An Extreme Lateral Approach?

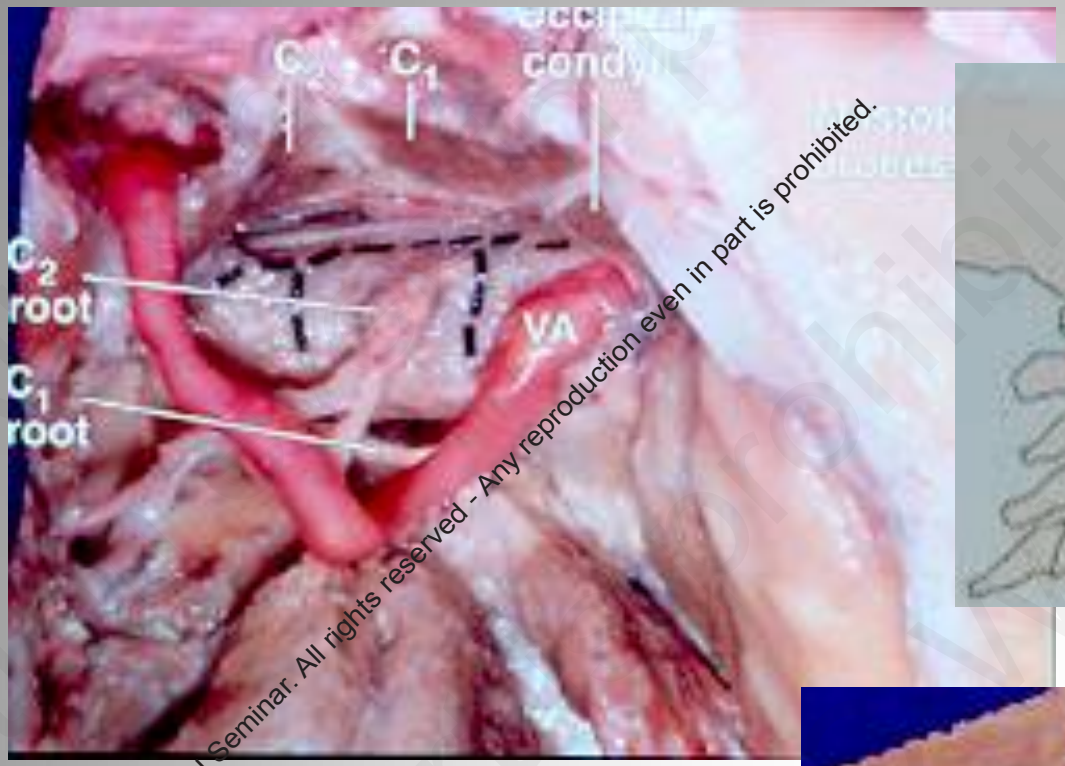
- Early Devascularization of Tumor
- Brain Stem / Spinal Cord manipulated minimally
- Total Tumor Resection with the Dura (Simpson Grade 1) Is Possible In Most Primary Cases
- Local Recurrence Is Rare After Total Microsurgical Removal
- CSF Leak is Rare
- Direct Proximal Control of the VA (contralateral VA can be exposed intradurally)

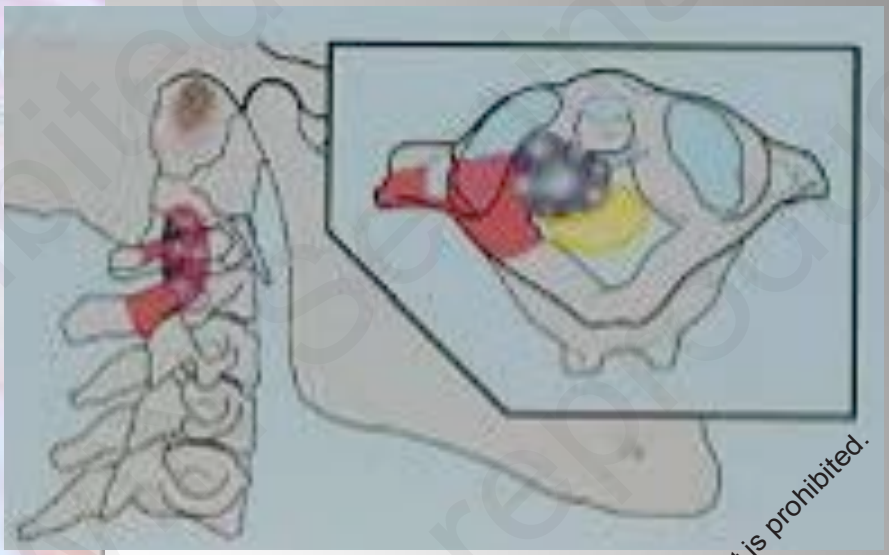
2017 © ABC - WN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Transfacetal Approach: Lesions from FM to C3

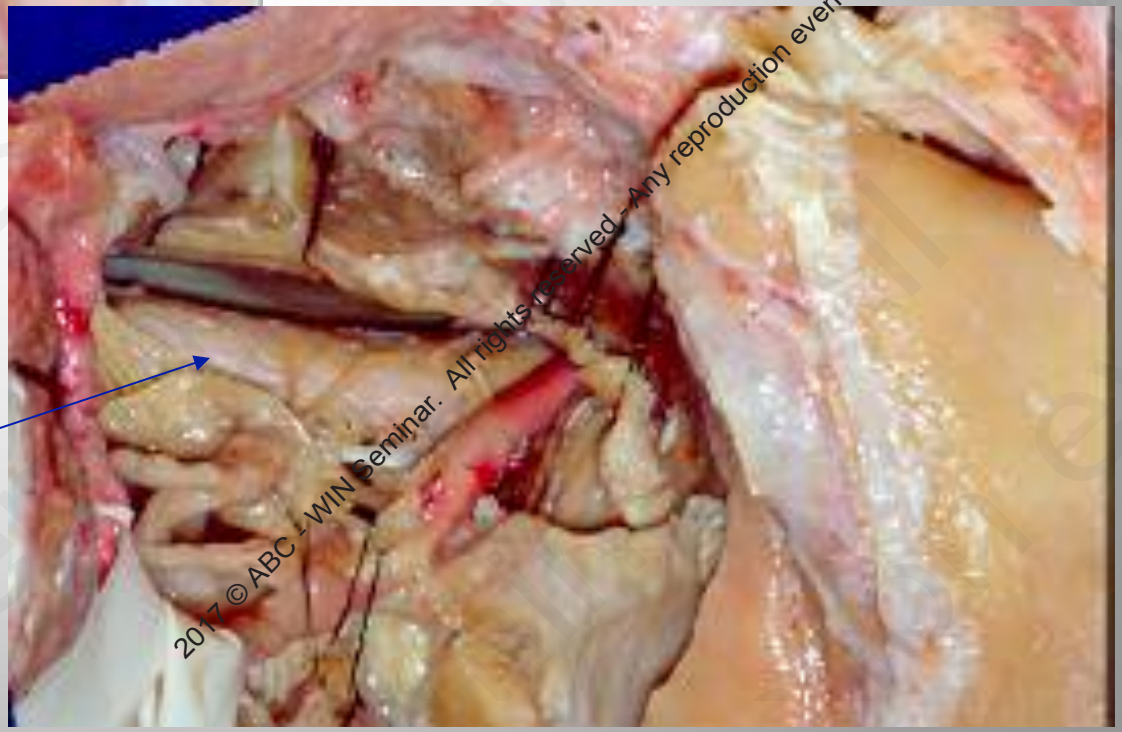
- Facet removed up to the foramen transversarium
- VA unroofed if needed
- Hemi laminectomy

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



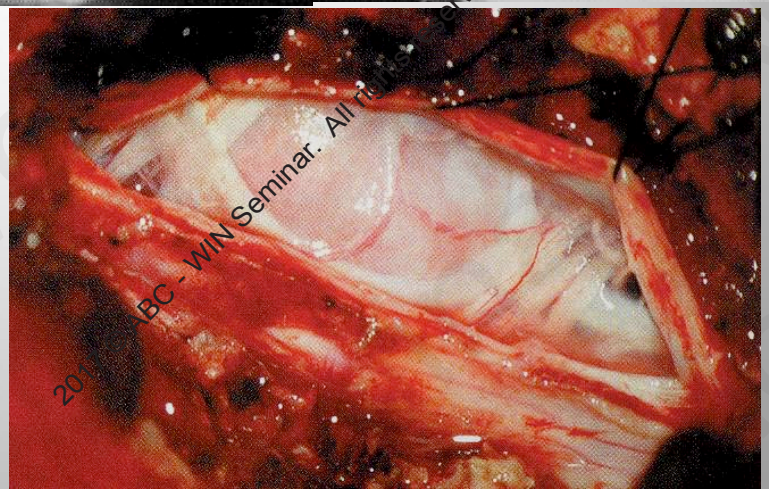


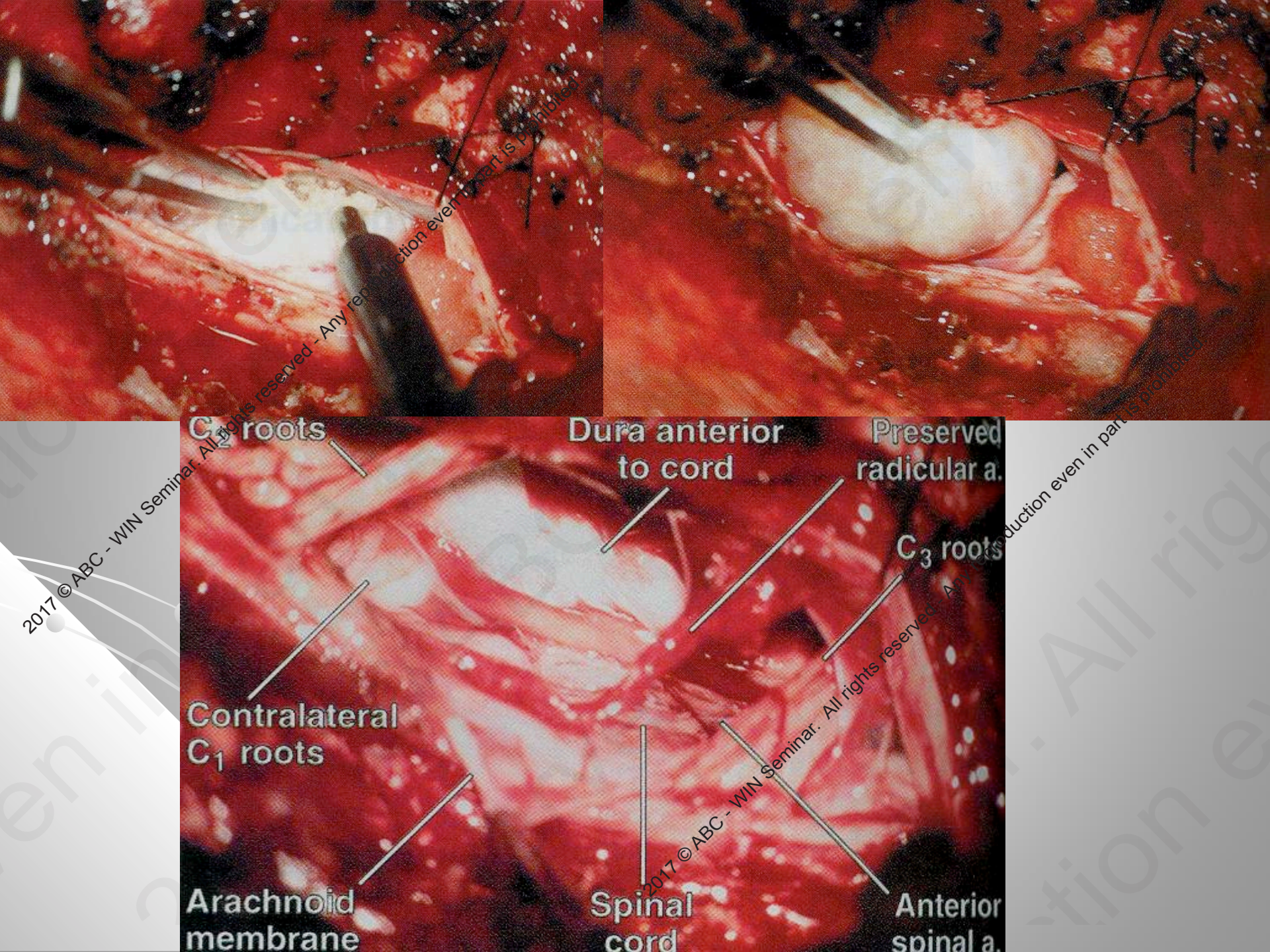
Trans Facetal Approach



Spinal Cord

Transfacetal Approach





Foramen Magnum Meningiomas

- A Partial Tran condylar Approach is indicated when the tumor is Anteriorly placed to the Spinal Cord and Medulla
- A Retro condylar Approach may be performed when the tumor is Lateral to the Spinal Cord and Medulla
- A Complete Trans Condylar Approach is Rarely Needed; so an *OC Fusion is Rarely necessary*

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Summary of HMC Cases (2005-2016,surgeon LNS)

- Total cases n=21(F=14, 66.6% ; M=7, 33.3%)
- Mean age 58.6 yrs(Range 14-78)
- Mean symptom duration 23.6 months(Range 0.25 -120)
- Lower Cranial nerve involvement, n=5 (23.8%) ; Hydrocephalus, n=6(28.5%)
- Family history of cranial meningioma ,n=3(14.2%); Extraneural malignancy ,n=2(9.5%)
- Mean Preop KPS 71.8 (Range 50 – 90)
- Location;
  - Lateral Extension
    - Central, n=11 (52.4%)
    - Centrolateral / Lateral ,n=10 (47.6%)

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Rostrocaudal Extension

Predominantly above FM, n=15 (71.4%)

Predominantly below FM, n= 6 (28.6%)

- Artery Encasement, n=4 (19%)

  Vertebral artery, n=4 (19%)

  PICA , n=2 (9.5%)

- Tumor Sizes;

  Small,<2cms;n=6(28.6%)

  Medium,2-3.9cms; n=9(42.8%)

  Large,>4cms; n=6(28.6%)

  Mean maximum tumor size 3.34cms

- Preop EVD

  n=6 (28.6%)

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

- Approaches
  - Far Lateral , n=14(66.6%)
  - Extreme Lateral , n=7(33.3%)
  - (Transcondylar n=19, 90.4% ; Retrocondylar n=1,4.7% ; Transfacetal n=1,4.7%)
- Mean surgery duration 8.2 hours (Range 5.1- 12.25)
- Mean estimated blood loss 415ml (Range 100-1200)
- Resection
  - Gross Total, n= 16(76.2%)
  - Near total (small residue) ,n=5(23.8%)

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

- Postoperative complications
  - Wound infection , n=1(4.7%)
  - CSF leak , n=1(4.7%)
  - Pseudomeningocele , n=1(4.7%)
  - Lower CN palsy worsening , n=4(19%)
  - Tracheostomy , n=2(9.5%)
  - Occipitocervical instability, n=1(4.7%)
  - Extracranial Vertebral Artery Injury (N=1, Successful repair)
- WHO Grade
  - Grade I ,n=19 (90.5%)
  - Grade II atypical, n=2 (9.5%)
- Recurrence, Eventual Death (WHO Grade 2 Tumor) , n=1(4.7%)
  - > Re Operation (Operated Elsewhere; Operated at HMC; Recurred after 2 years; Neuraxis Metastasis; Death)
- Adjuvant Radio therapy , n=2(9.5%)

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

- Mean Postop KPS 84.2 (Range 60 – 90)
- Mean Follow-Up 62.1 months (Range 8-132 months)
- Death in one patient due to progressive tumor growth and cervicomedullary compression (WHO II, Operated outside & Referred to HMC following rapid recurrence)

Endovascular Management Summary

- Preoperative Embolization n=8 (38%)
- Vascularity; Hypervascular 3(14.2%) ; Hypovascular 5(23.8%)
- Major Feeders;
  - Ascending pharyngeal, n=8(38%)
  - Sphenopalatine, n=7(33.3%)
  - Middle meningeal, n=7(33.3%)
  - Occipital, n=6(28.6%)
  - Vertebral, n=4(19%)
- Feeder Embolization;
  - Ascending pharyngeal, n=8(38%)
  - Sphenopalatine, n=1(4.7%)
  - Vertebral, n=1(4.7%)
- Embolization agent used ; PVA particles in all cases and gelfoam in one case

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Partial Transcondylar Approach

- Posterior 1/3rd to ½ of Occipital Condyle and Lateral Mass of C1 removed
- Allows approach anterior to VA entrance and Spinomedullary junction without brain stem retraction
- VA can be dissected completely, mobilized posteriorly
- Better View of VA-Basilar Junction
- No fusion needed
- Dura is opened with cuff around VA to allow closure
- Dentate ligaments and C1 rootlets are divided after dural opening
- Be Careful at VA dural Entrance, Spinal 11 Nerve
- Main Window Of Operation Is From CN XI to C2 Rootlets
- Careful Closure Needed to Avoid CSF leakage

ELZIE DYMPLINE
H2480845

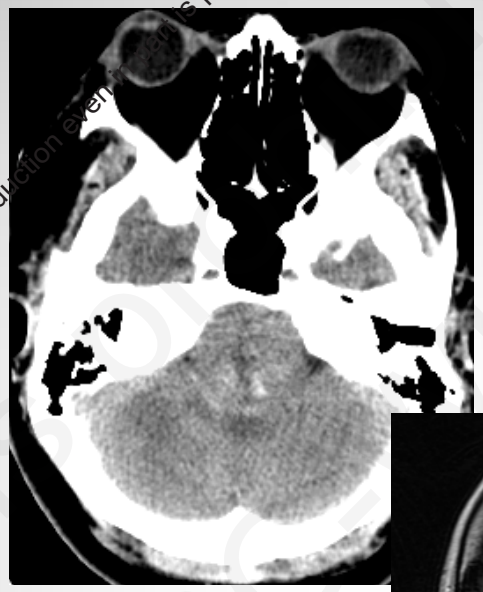
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

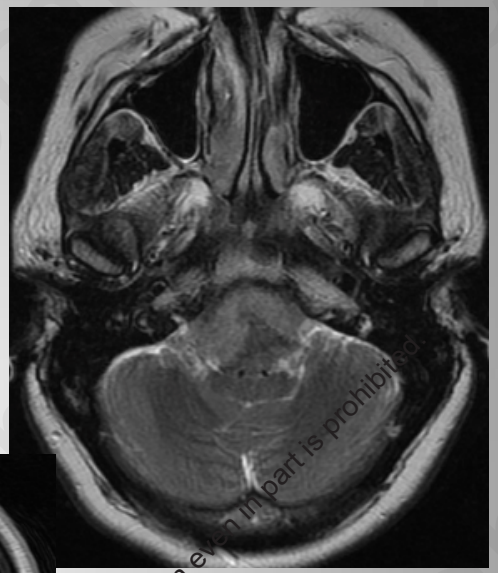
Lower Clival Meningioma:
Presenting with Hemorrhage

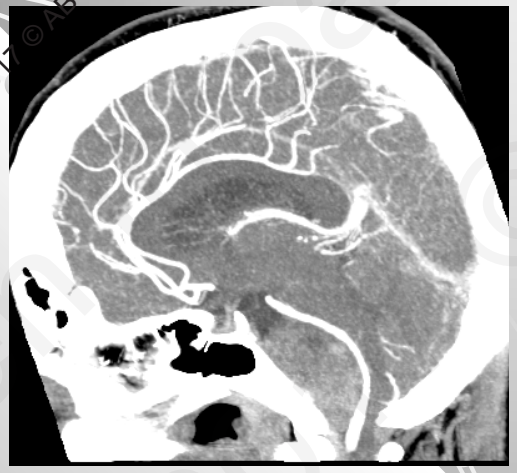
- 48 / F
- Lower Cranial Nerve Symptoms, Diplopia, Headache: 1 Week
- Exam: Bilateral CN 9 & 10, Right CN 6 Palsy
- Preoperative Karnofsky 60

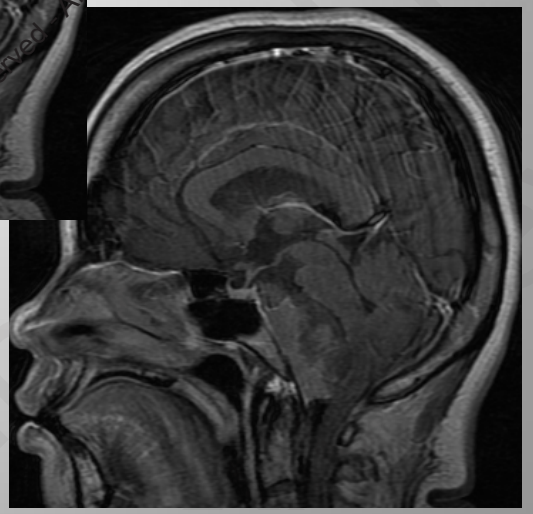
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

PREOP CT & MRI 10/7/2005







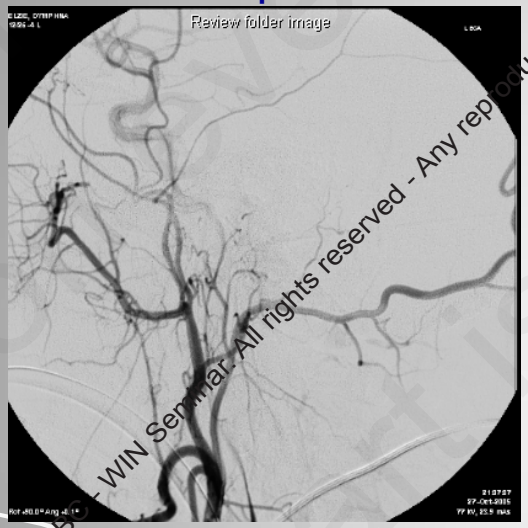


Hemorrhagic Lower Clival Tumor

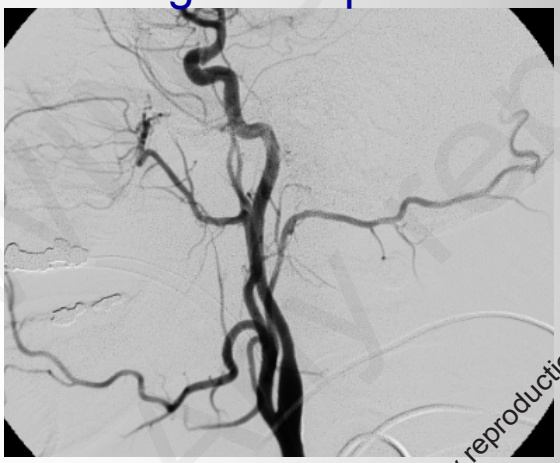
Preoperative Angiogram & Embolization: Bilateral Occipital Arteries with 250-350 micron PVA;

Ascending Pharyngeal with 350 -500micron particles

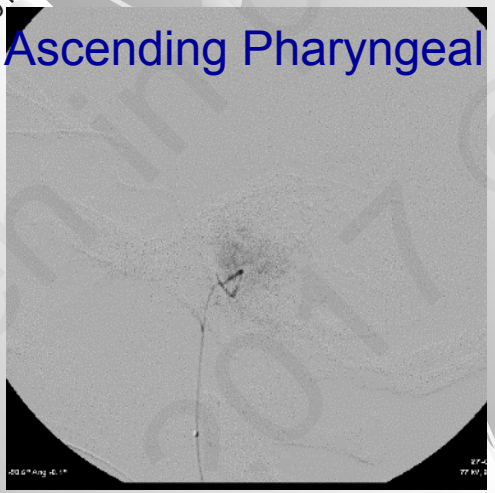
Left Occipital



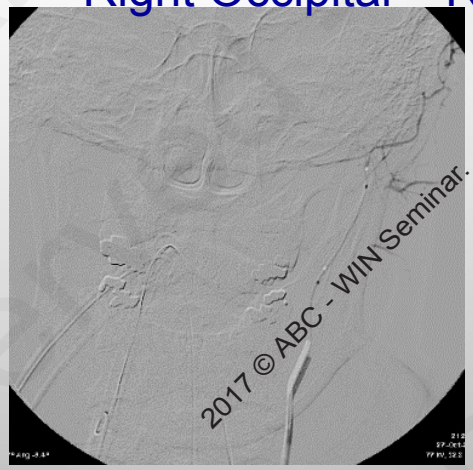
Right Occipital

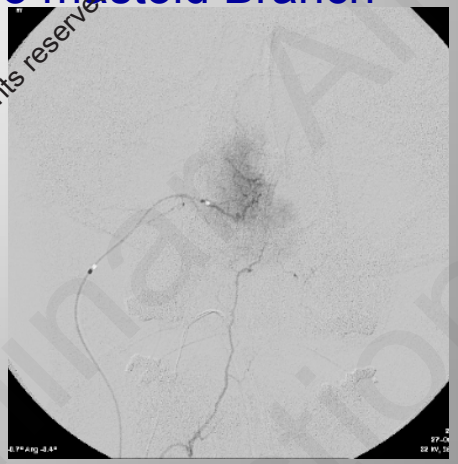


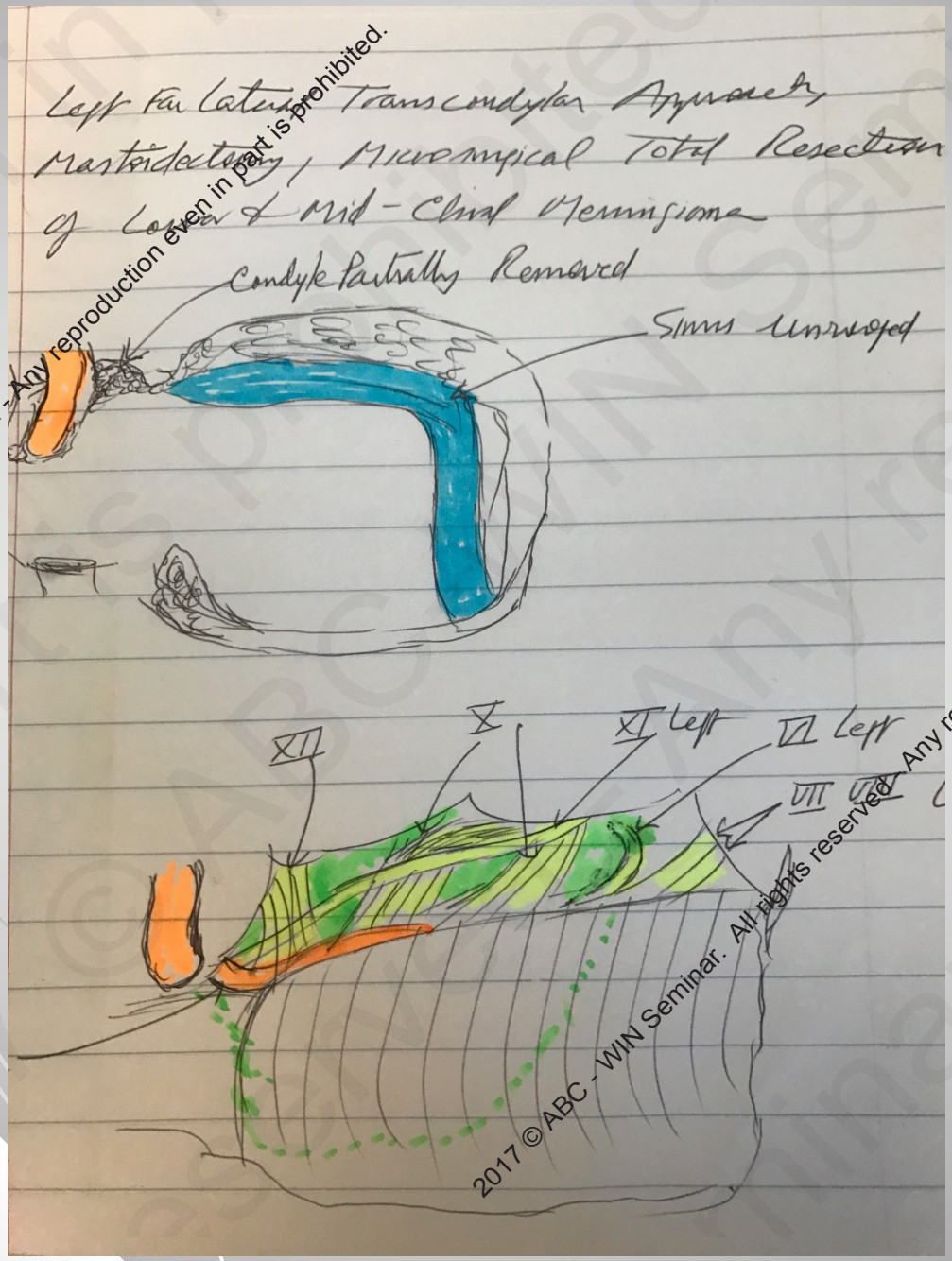
Ascending Pharyngeal



Right Occipital – Retro mastoid Branch

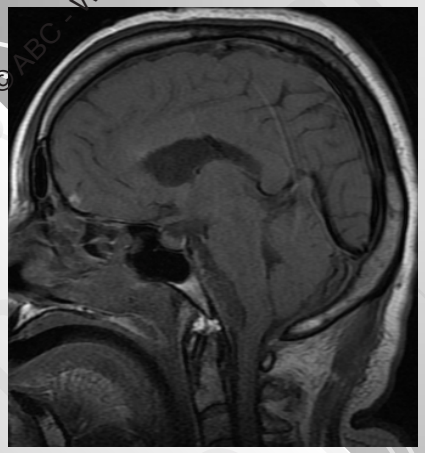


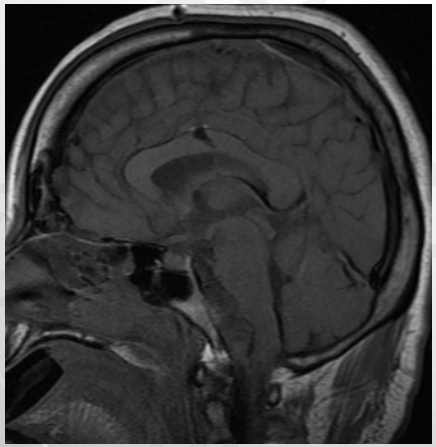




Surgery: Extreme Lateral Partial Trans Condylar Approach Complete Resection of a Hemorrhagic, soft Tumor

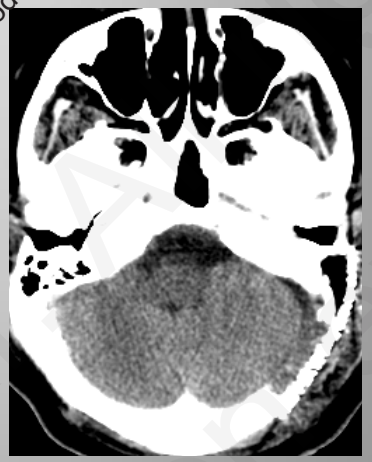
Postoperative: Worsened CN 9,10 Palsy
Tracheostomy, Gastrostomy,
Pneumonia, Recovered





Postoperative MRI 10.29.2005
Pathology: meningioma WHO Grade 1

Follow Up, at 2 Years:
Near Complete recovery of CN Deficits
Karnofsky 70
No recurrence



Follow Up CT Scan

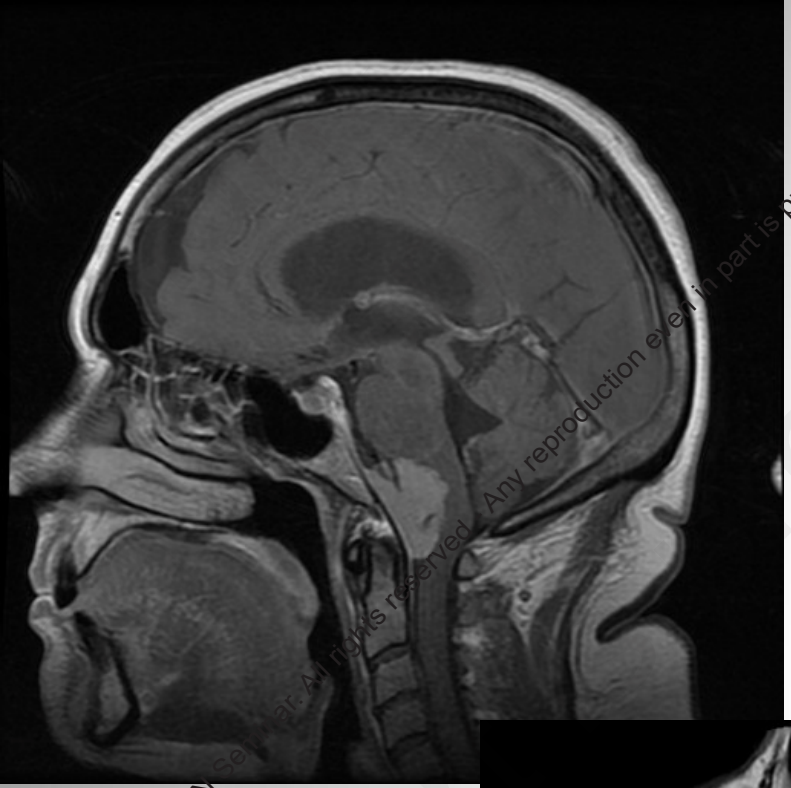
Janet Nelson
H2586660

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

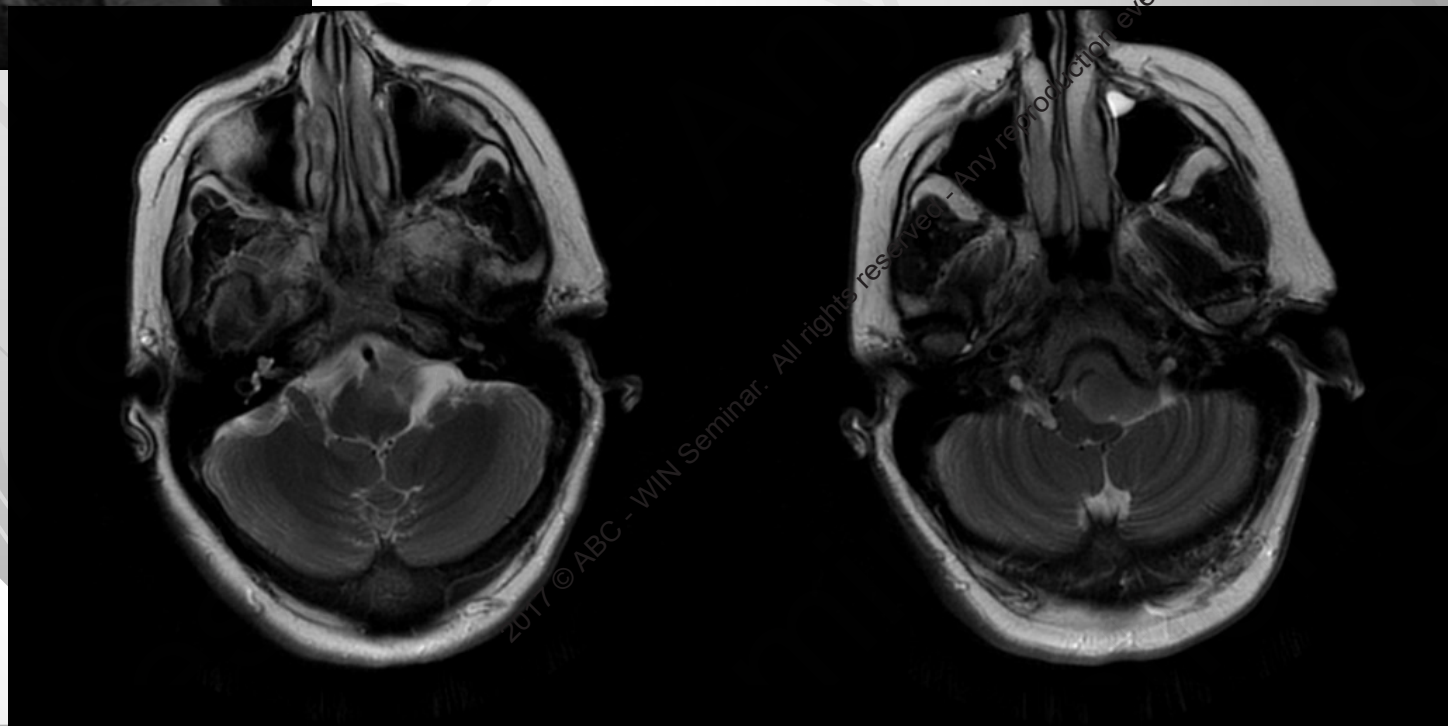
Case Summary

- 58 / woman
- Tingling, Numbness, weakness Right arm and leg
- Recent difficulty with Swallowing and Speech
- Exam: CN 9,10 weakness, L Arm Ataxia, Bilateral Lower Limb Spasticity
- Large FM Meningioma, Anterior Lesion

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

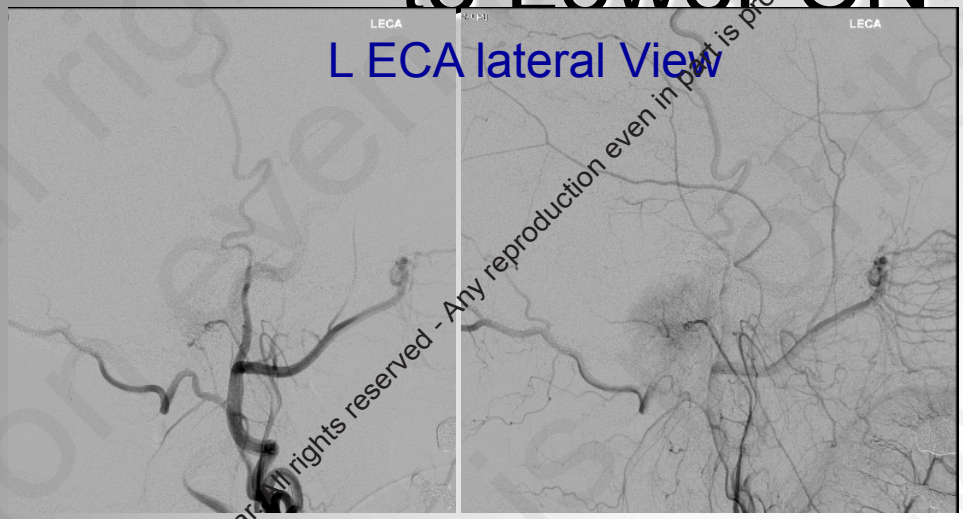


Left Vertebral Artery Encased

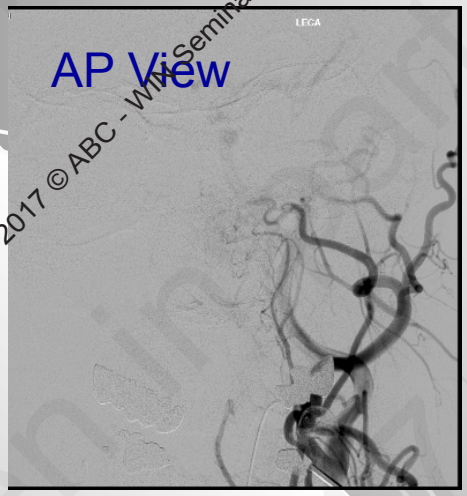


Pre Op MRI

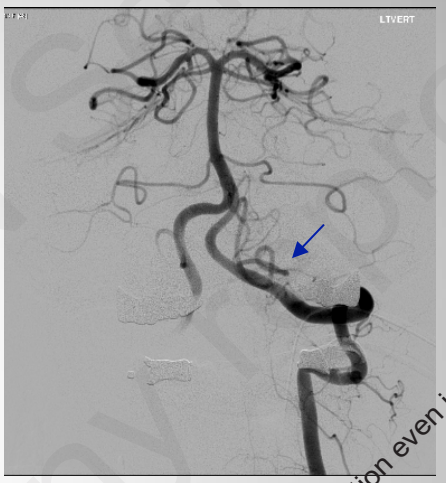
Angiogram; NO Embolization Done due to Lower CN paresis



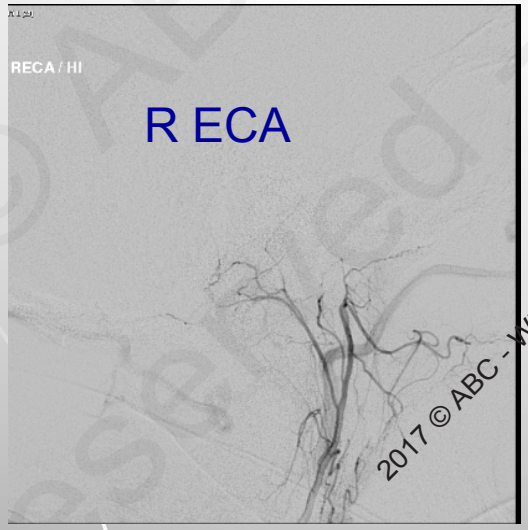
L ECA lateral View



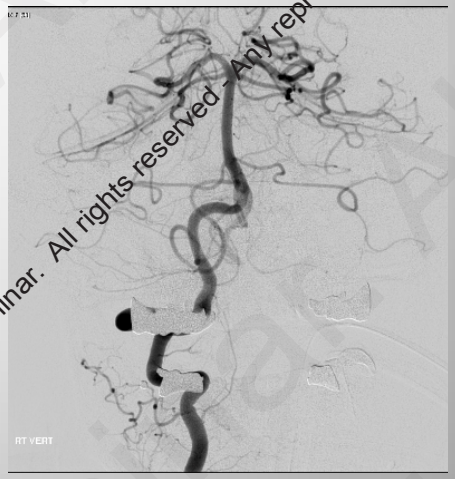
AP View



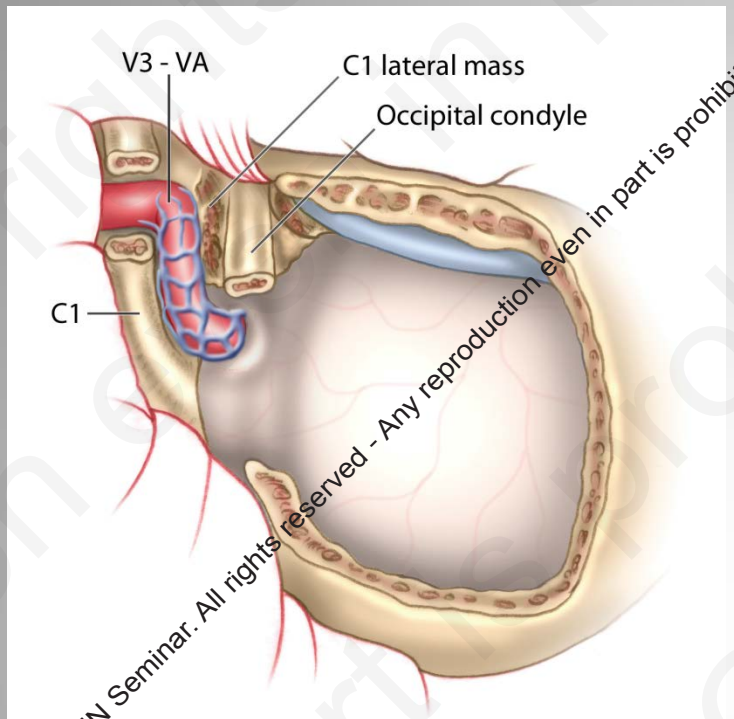
L VA Encased

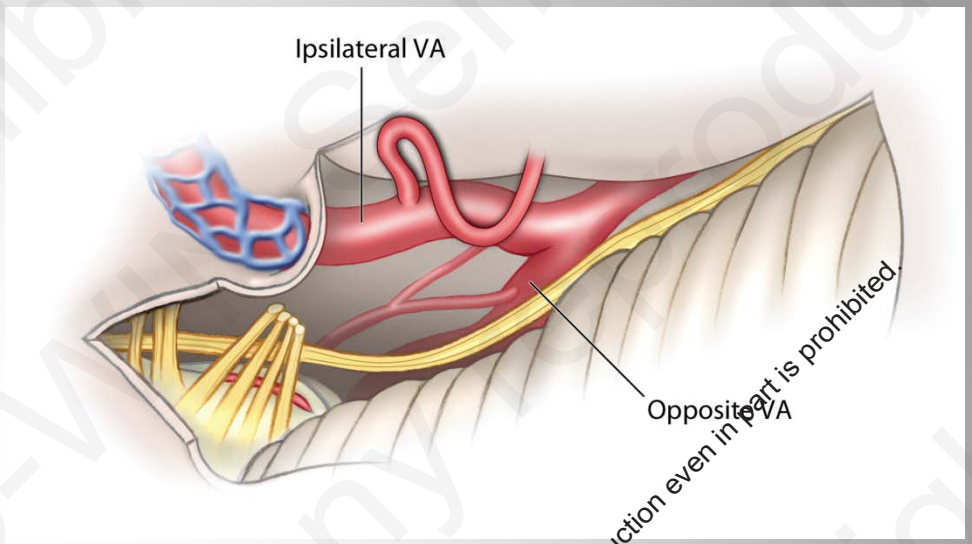


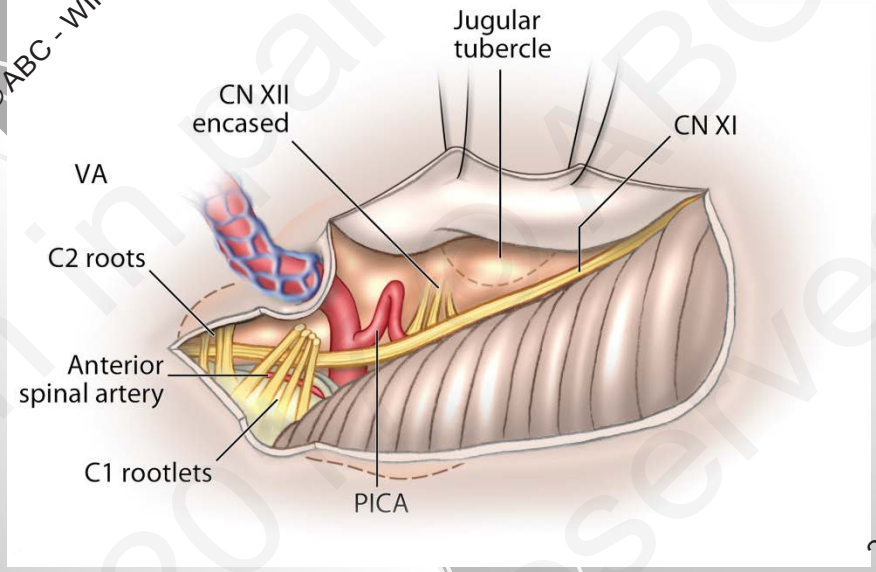
R ECA



R VA



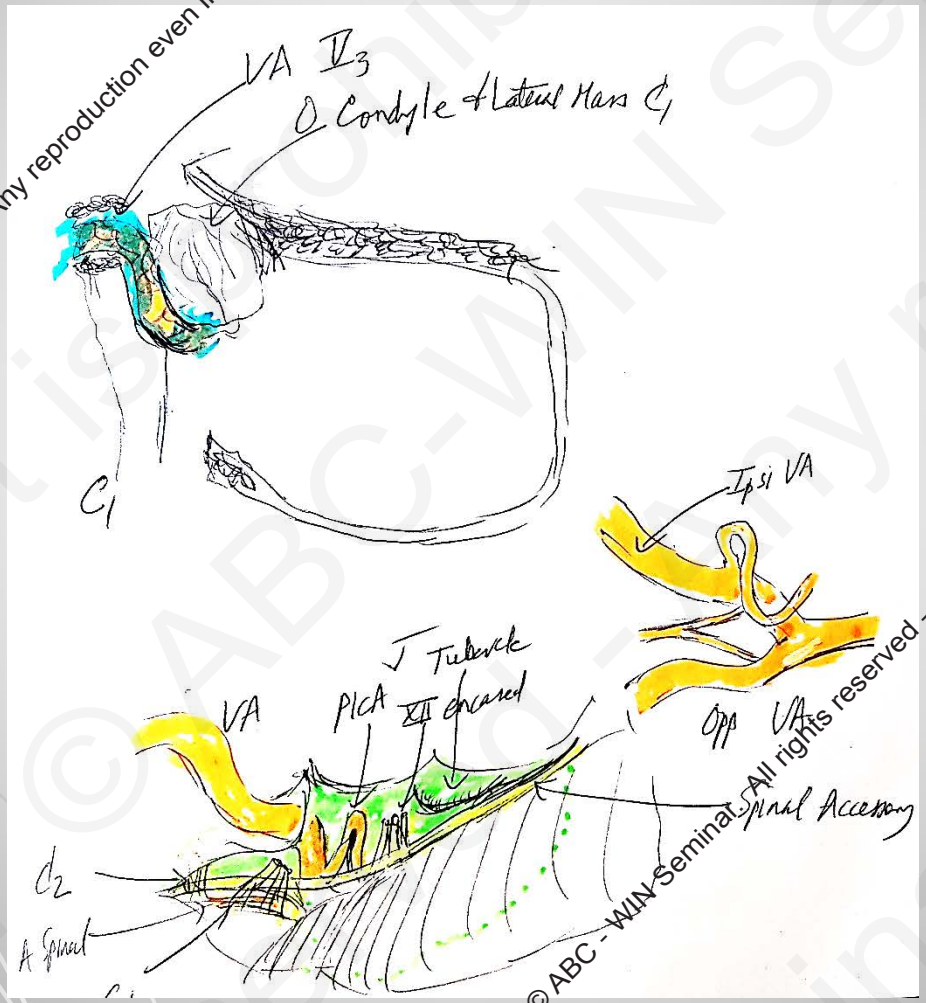




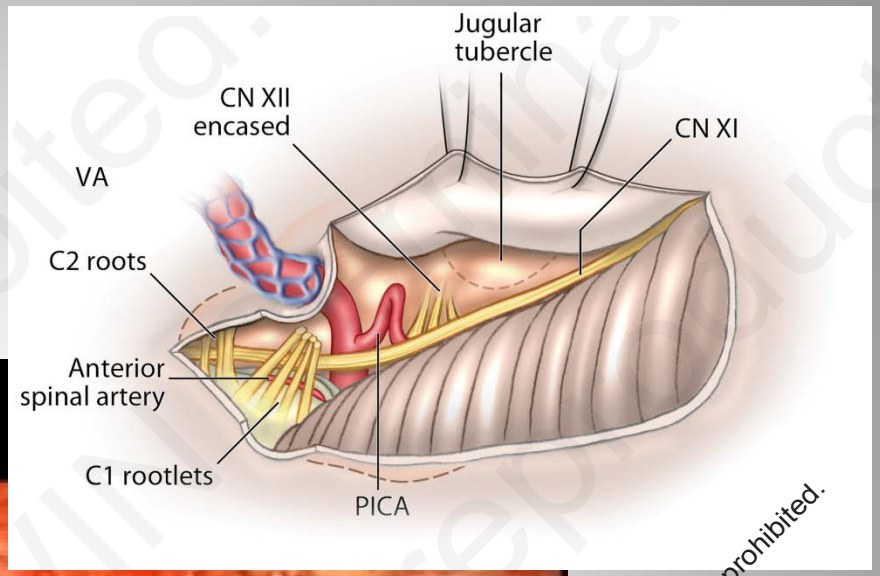
- Extreme Lateral Partial Trans condylar Approach
- Total Resection
- Postoperative Deep Venous Thrombosis,
- Resolved
- Recovery without any Deficits

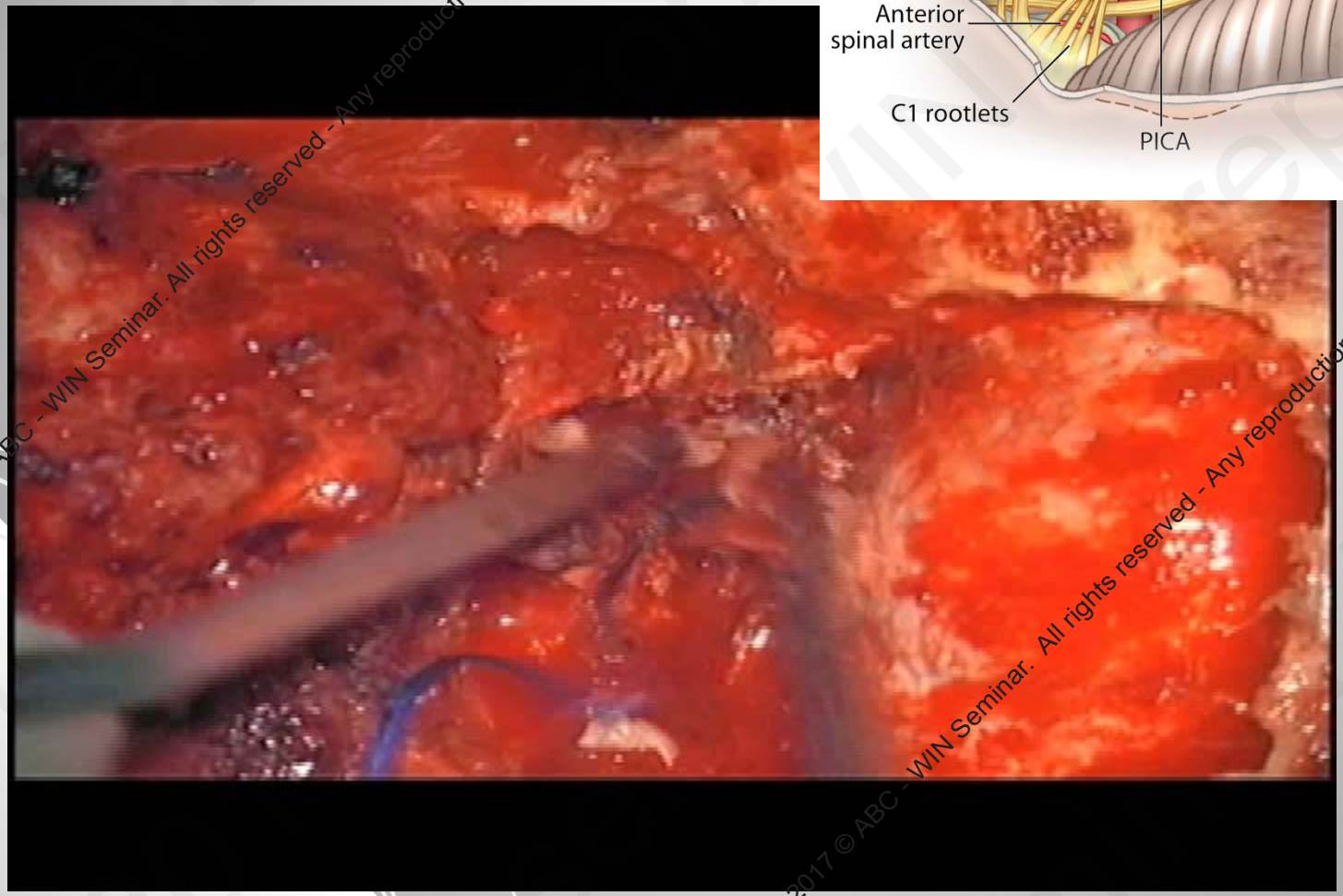
OPERATIVE SKETCH

Left-sided far lateral approach, partial transcondylar approach, with resection of jugular tubercle, complete microsurgical removal of tumor

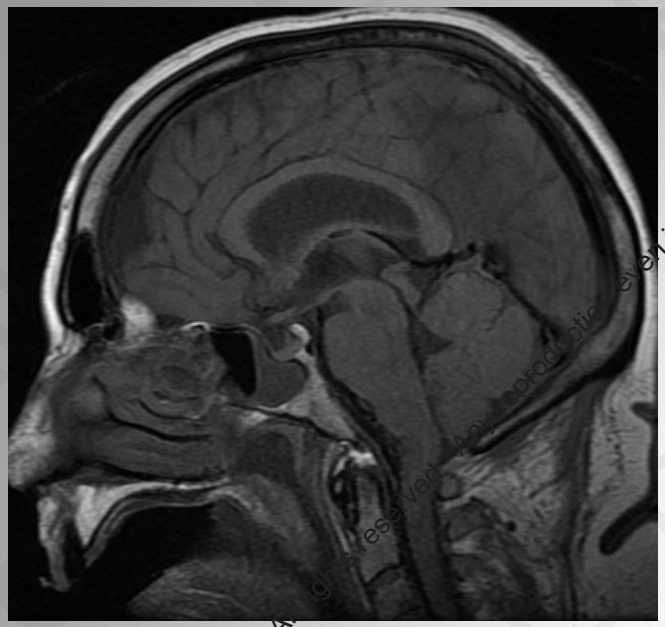


2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.





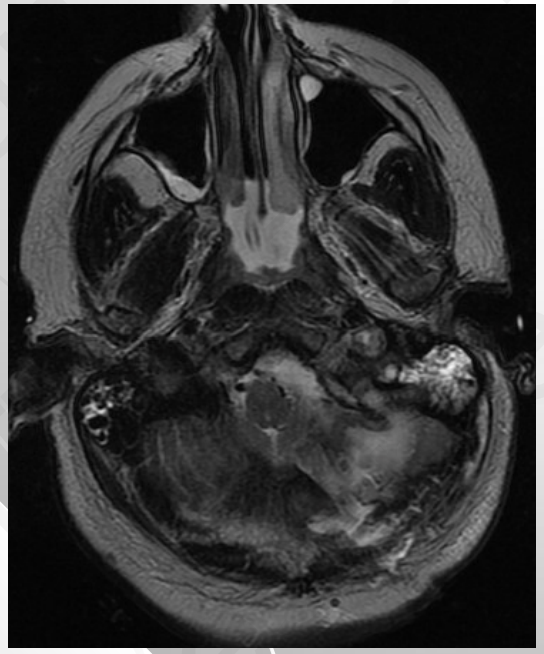
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

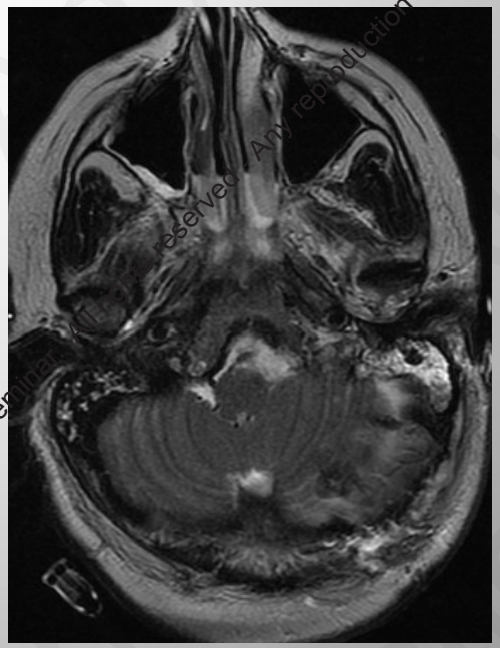


Postoperative Course:

Left CN 9,10, 12 Palsy
Vocal Cord Plasty
Complete Recovery
Karnofsky 80
No recurrence on follow Up

Post operative MRI





Terry Schulze
H2441477

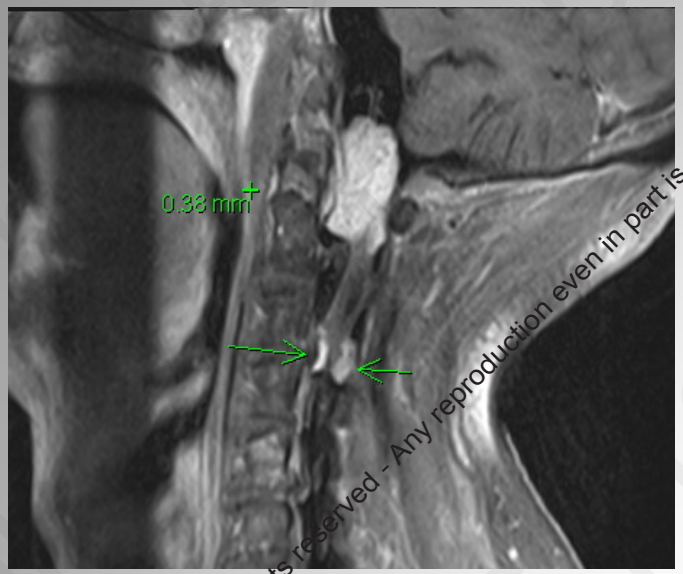
Case 2

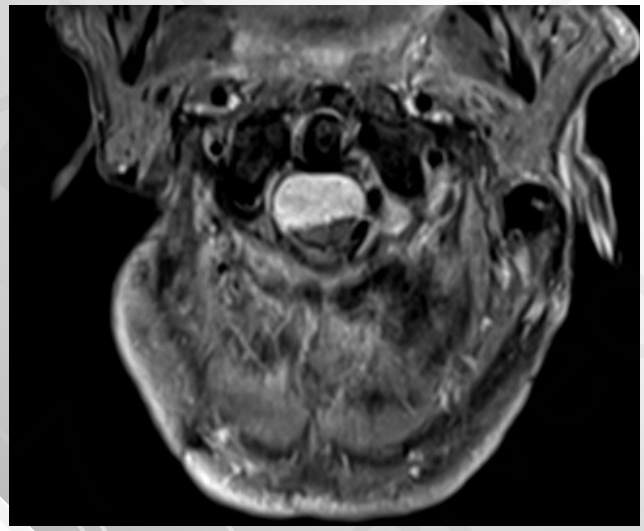
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

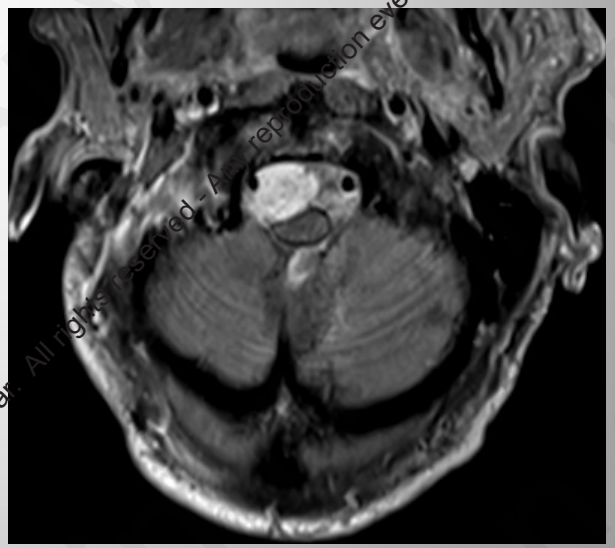
Case Summary

- 58 / man
- Recurrent, severe neck pain
- Previous Operations for a C2-3 Meningioma
- MRI Scan: FM, and C2-3 meningiomas
- Total Resection of Hemorrhagic, WHO Grade 3 Meningioma; Trapezius Flap
- Symptomatic Resolution
- Ultimately, Recurred in the Neck; Died from Tumor Progression

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

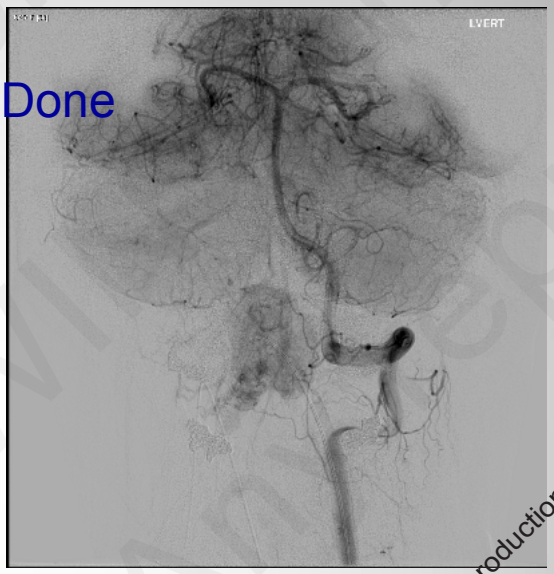




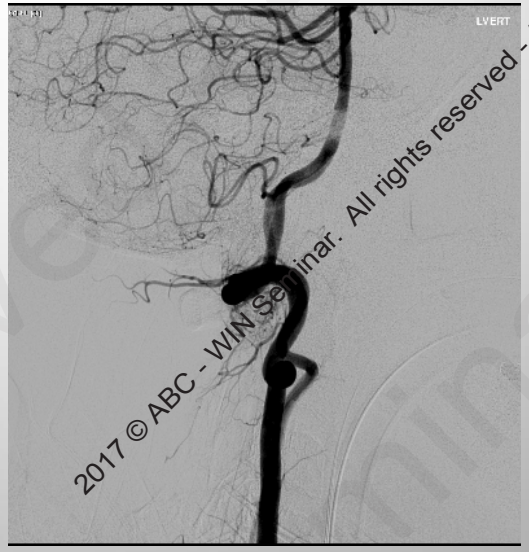


Angiogram

No Embolization Done

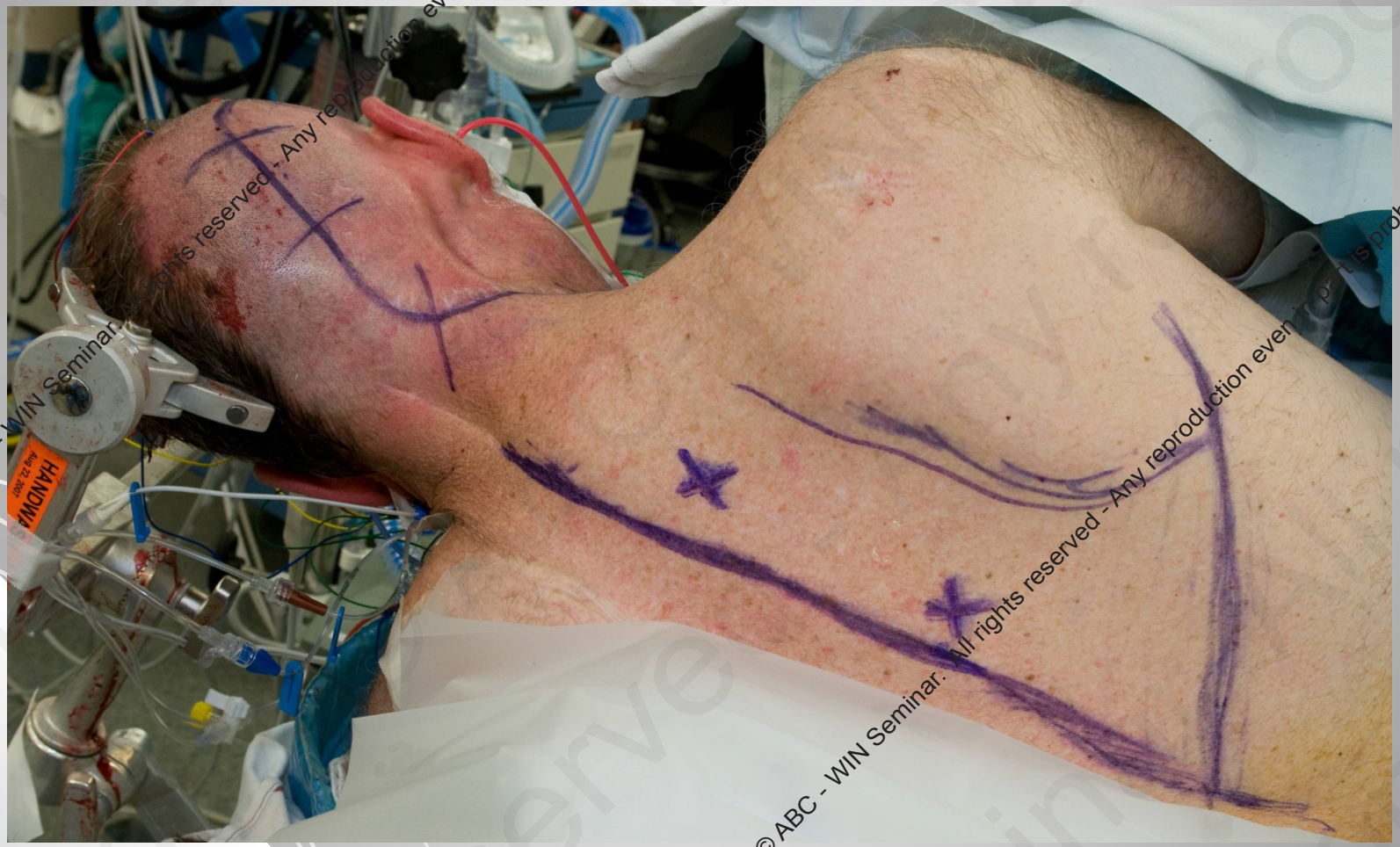


Two small muscular branches from the VA



2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

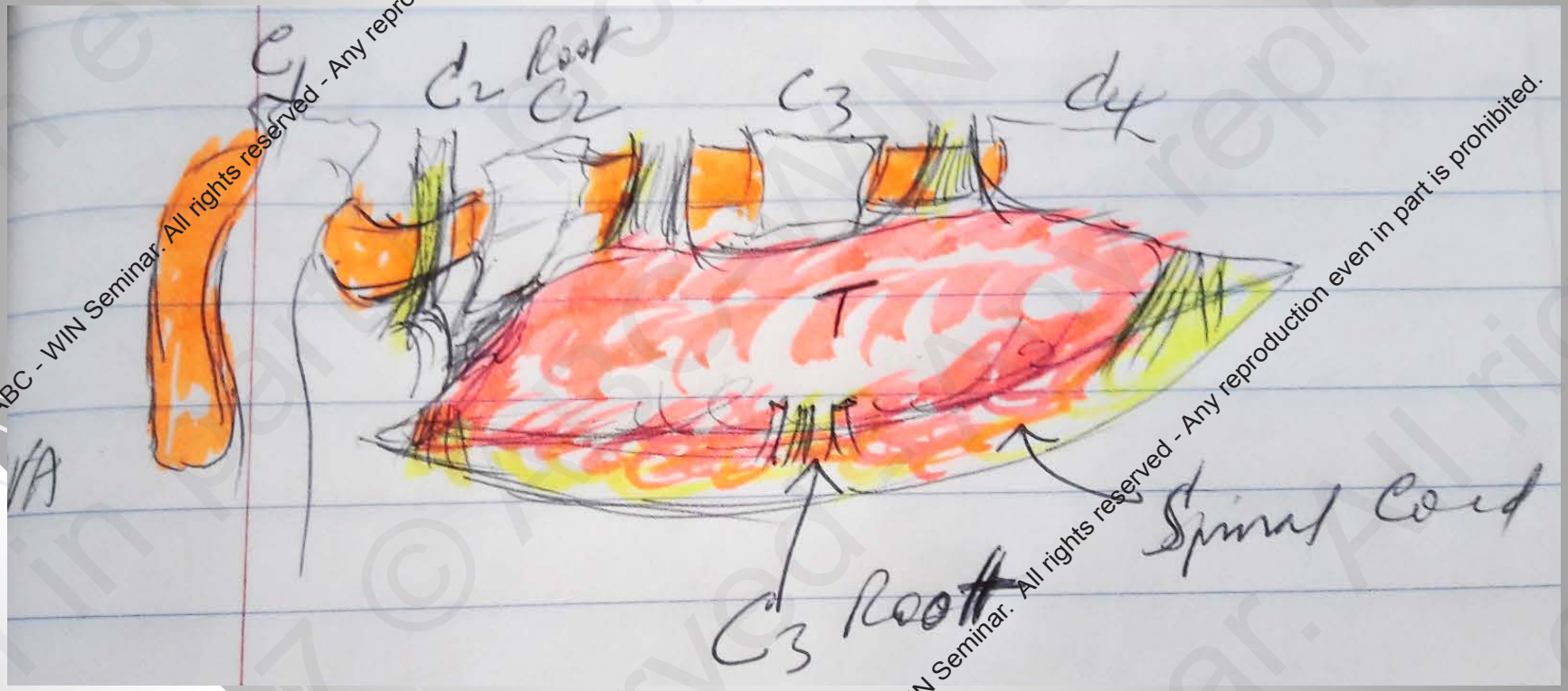
Patient Position

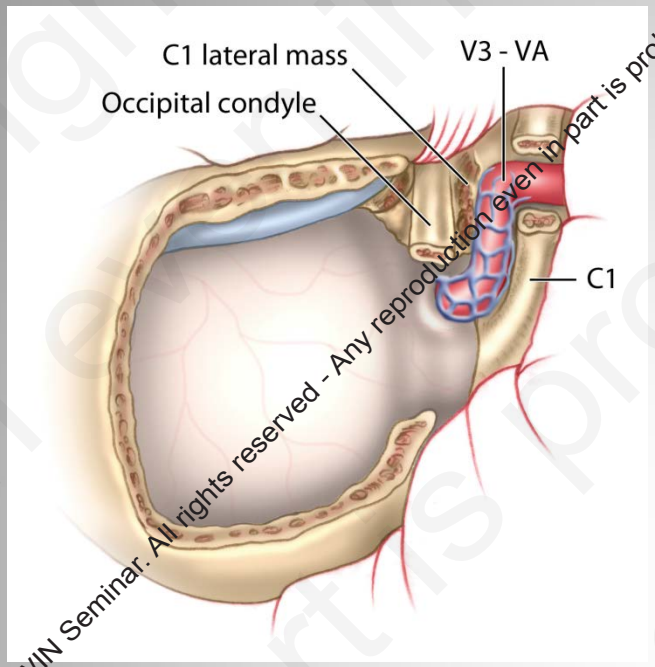


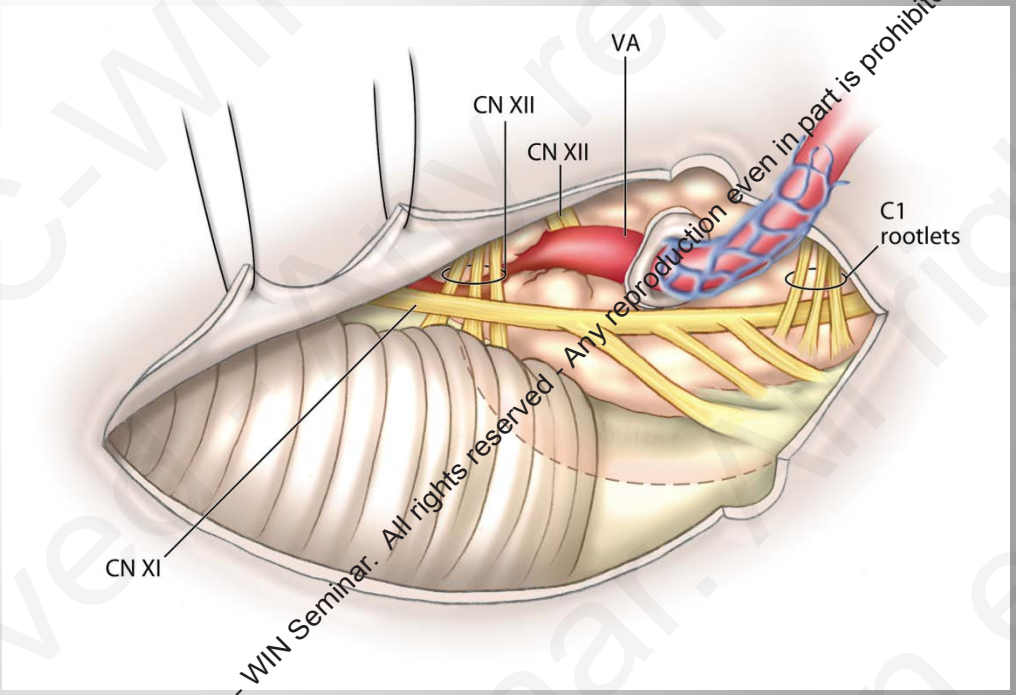
Site Marked for Trapezius Flap

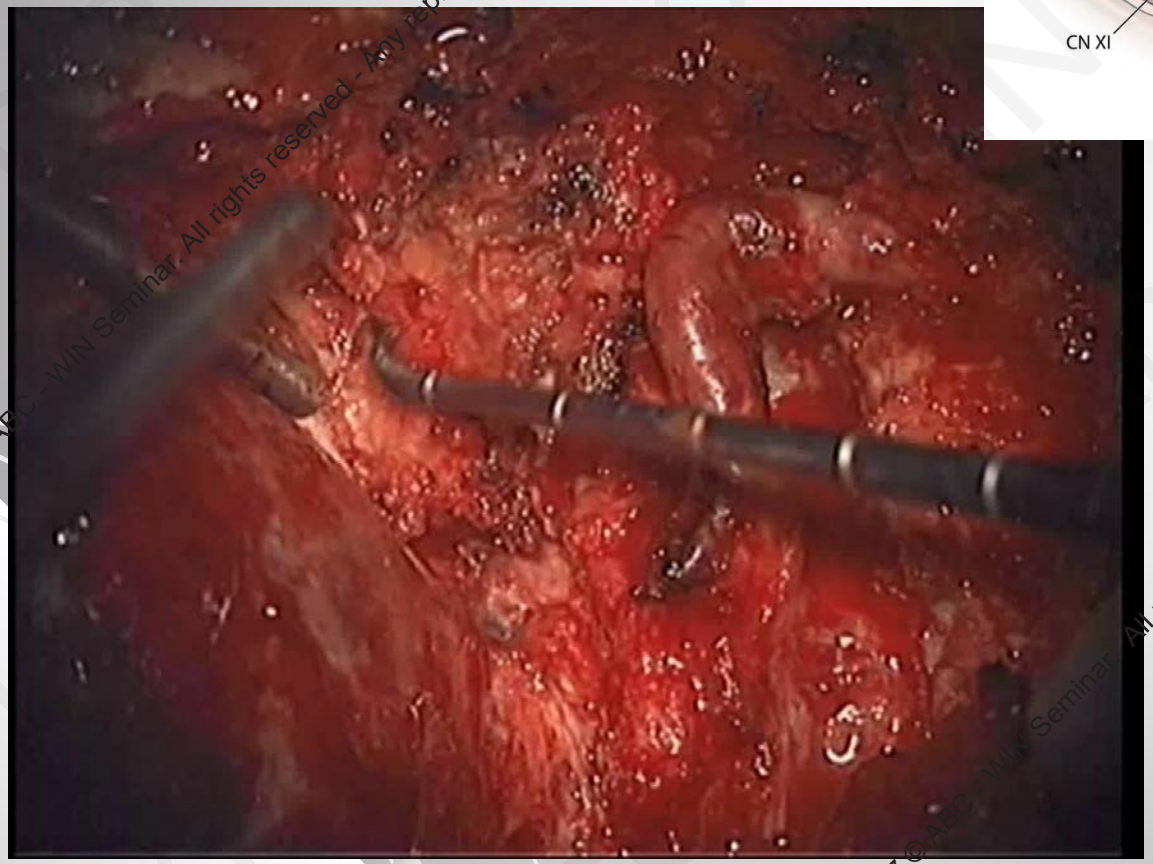
OPERATIVE SKETCH

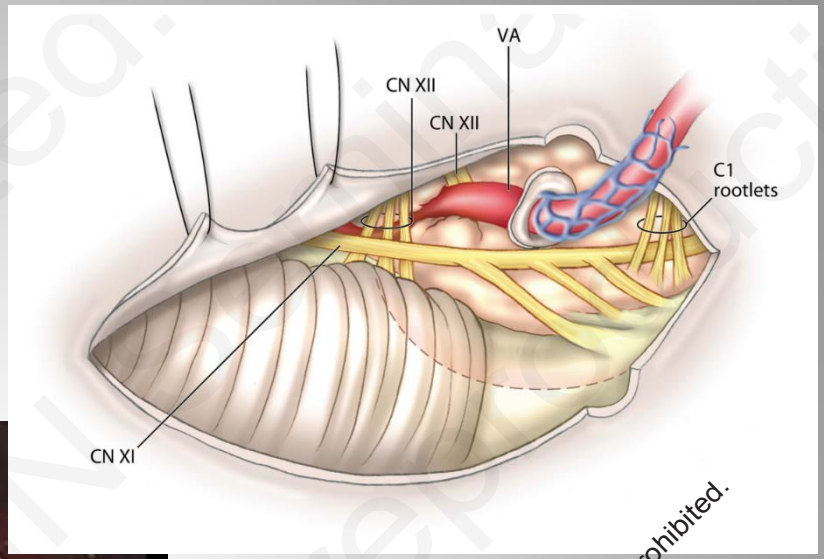
Right-sided extreme lateral transfacetal approach, with microsurgical complete resection of tumor



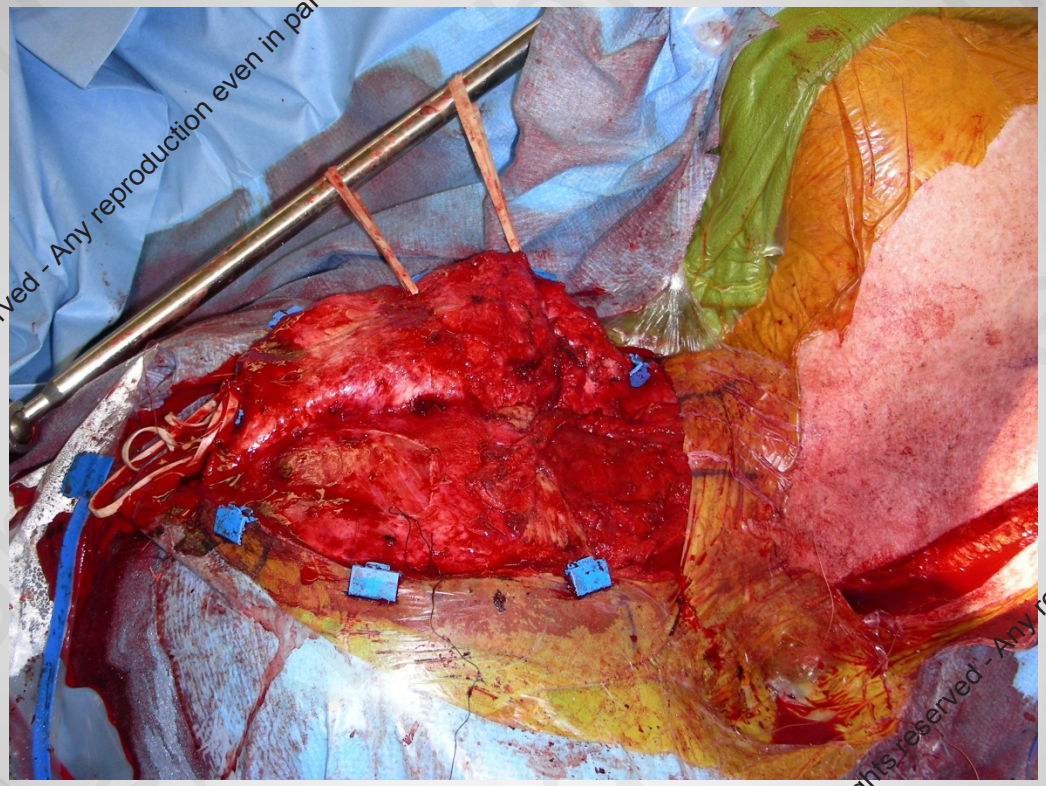






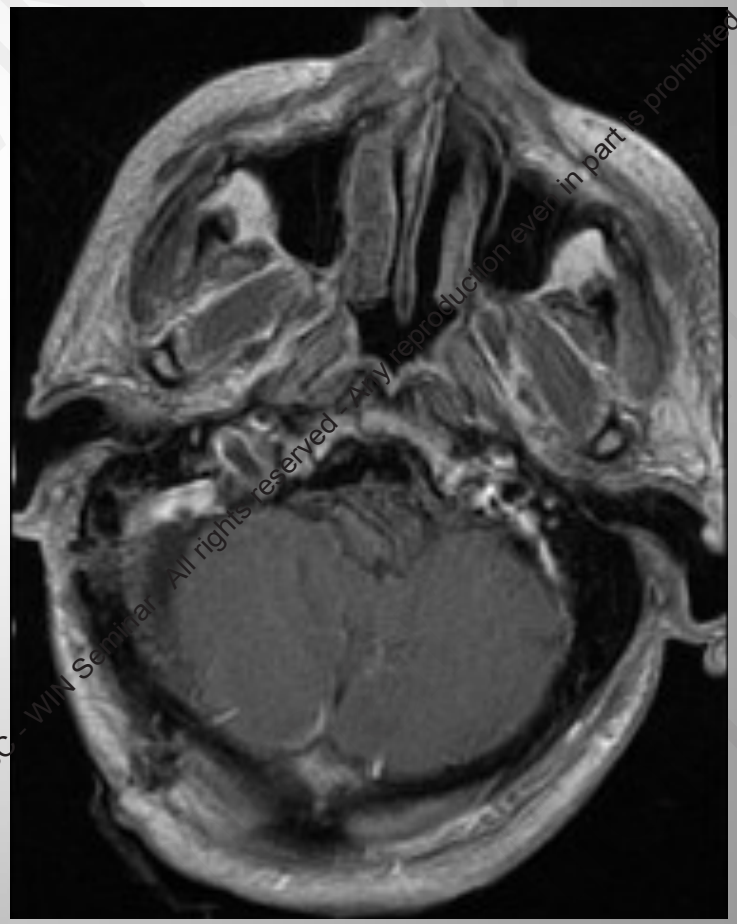


2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



Trapezius Flap In Place

Post operative



Dewitt MCMATH

Case 3

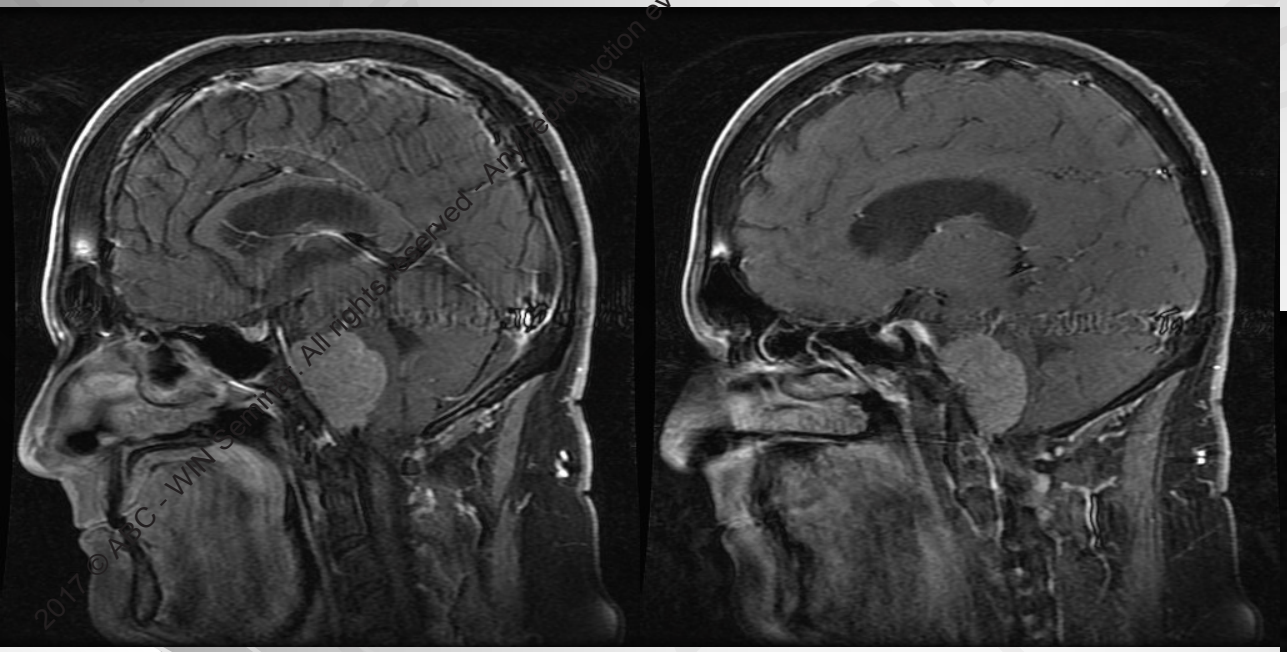
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

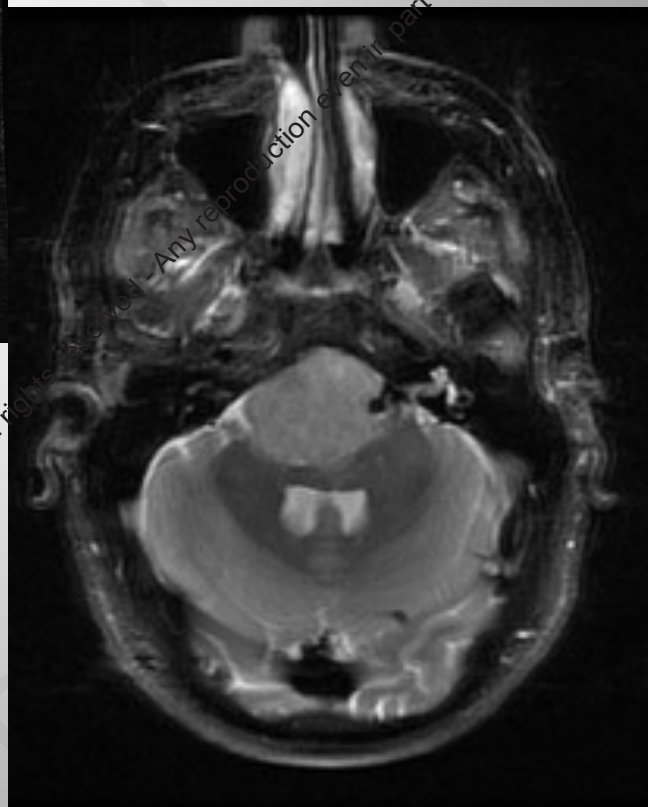
Case Summary

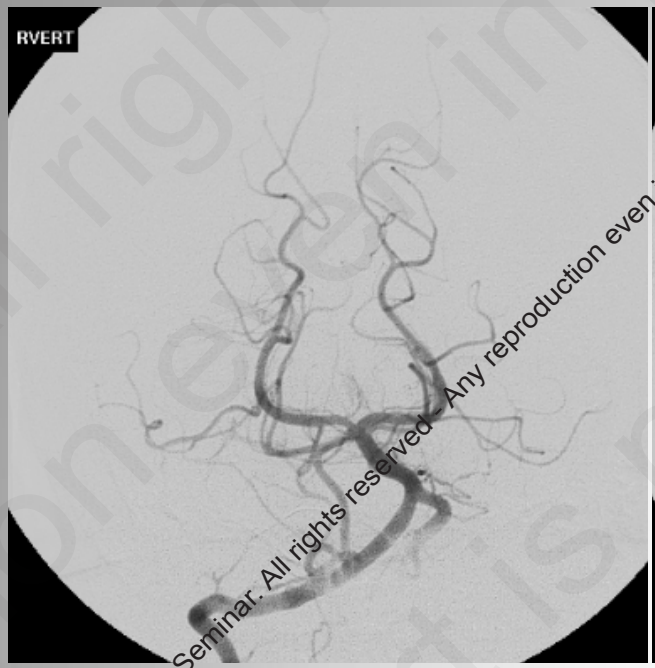
- 50 / man
- History: Numbness of lower extremities, slight arm weakness
- Jehovah's Witness (cannot take blood)
- Exam: Numbness both lower limbs; Slight weakness Right Upper Limb; Broad Based gait
- MRI: Large Lower Clival Meningioma
- Operation: Total Resection by Far Lateral Retro sigmoid Approach; Encasement of PICA, and Perforator arteries
- Postoperative : Sinus Thrombosis left; Pseudo Meningocele: Lumbar Drainage 5 days; Anti coagulation for 6 weeks
- Complete Recovery, Sinus Recanalized

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Mid and Lower Clival Tumor



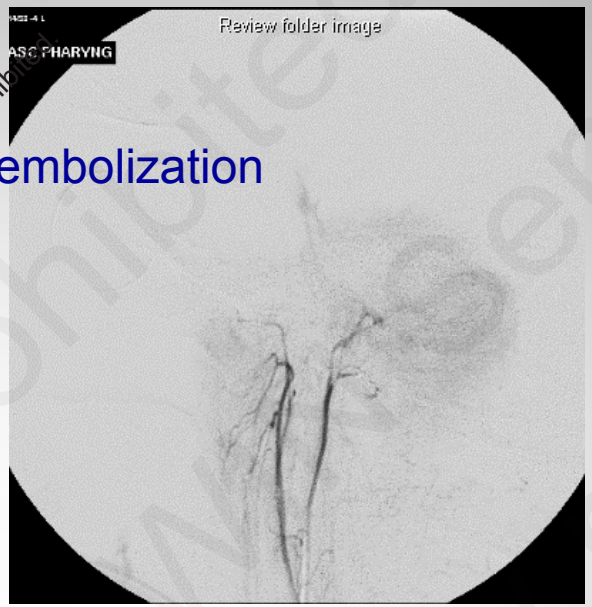




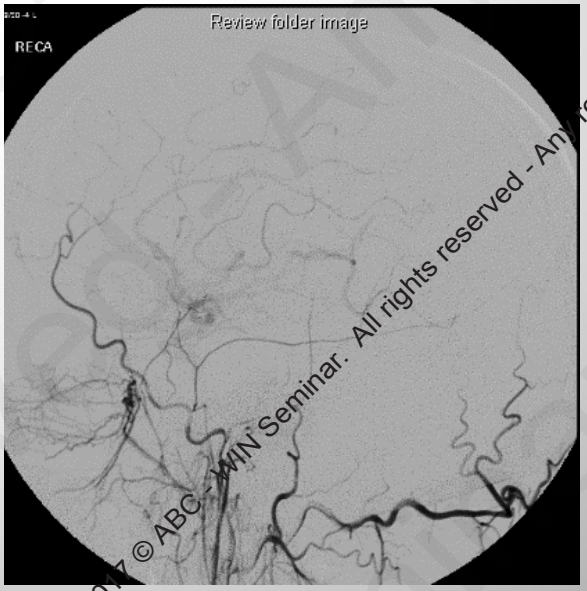
No Encasement Seen On Angiogram:

But PICA and Perforator found Encased at Surgery

Pre embolization

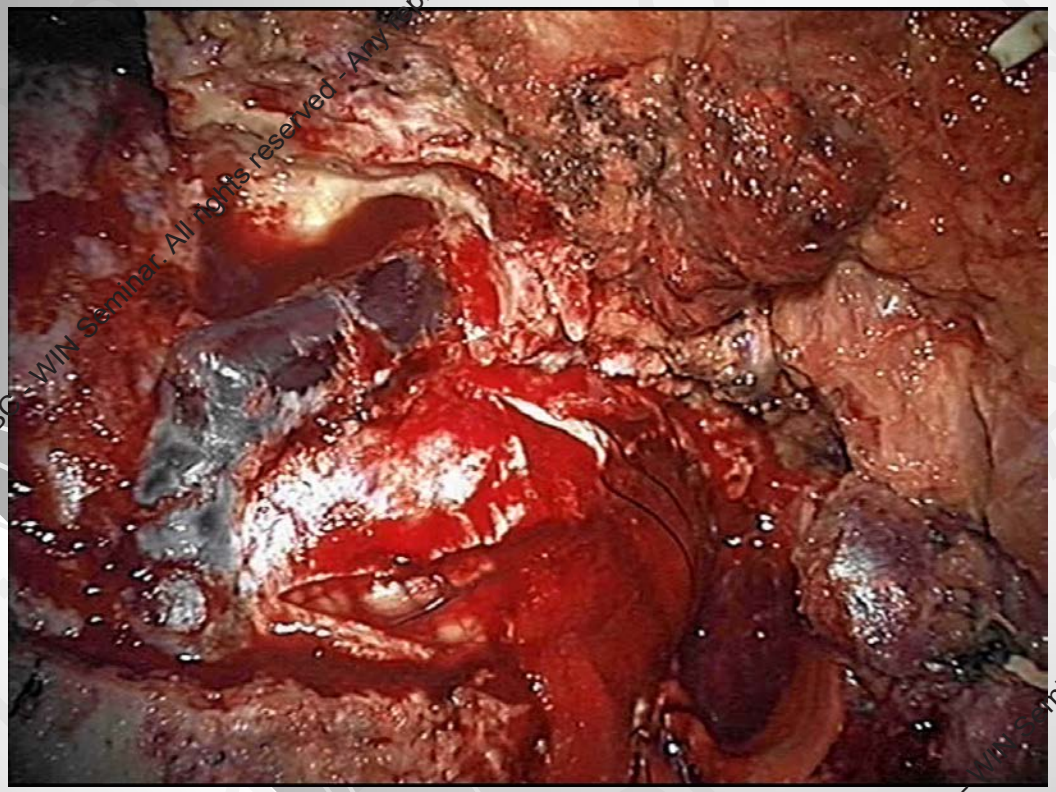


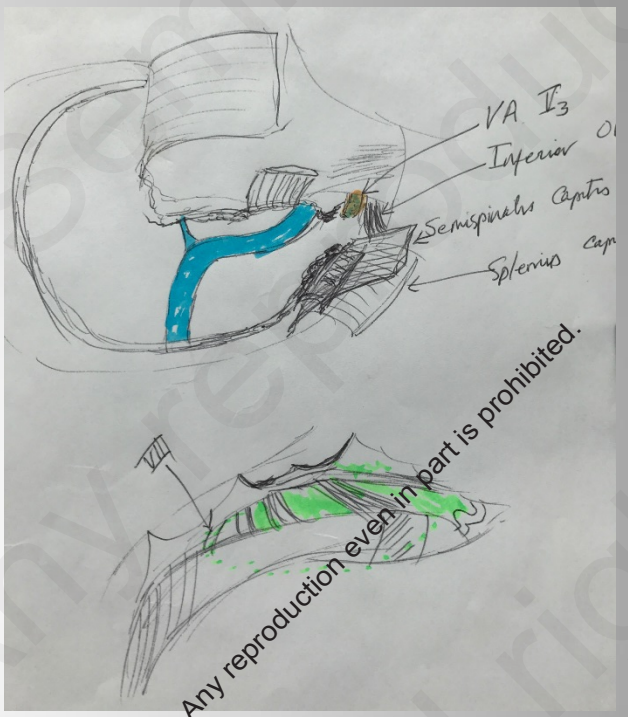
Coils placed in Occipital Branch;
Embo with PVA 150 -250 microns

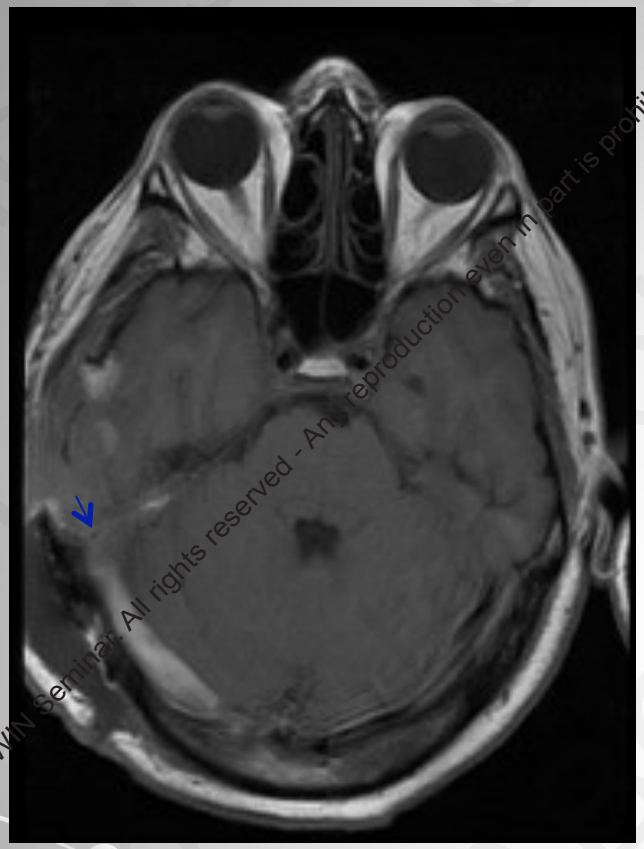


ECA run Post Embolization

Angiogram - Venous Phase

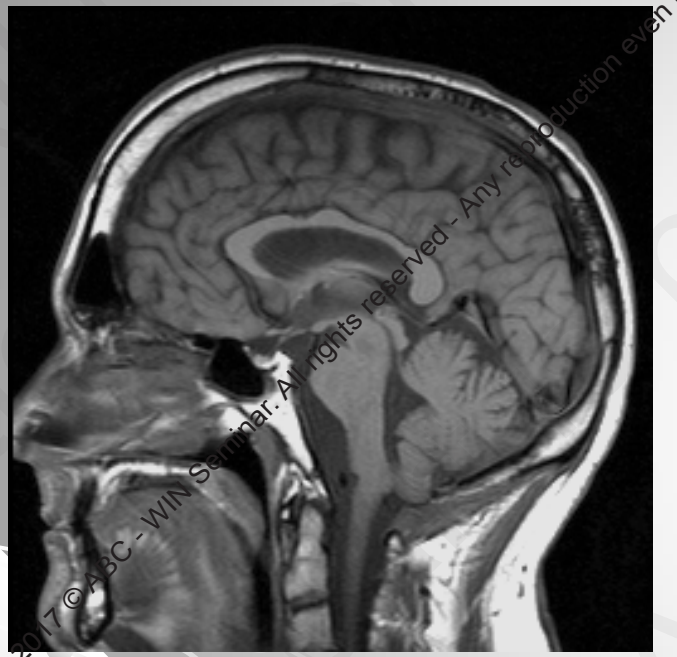


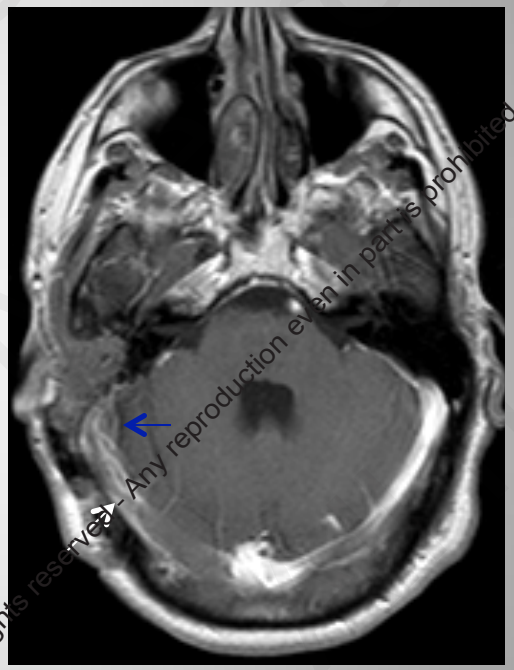




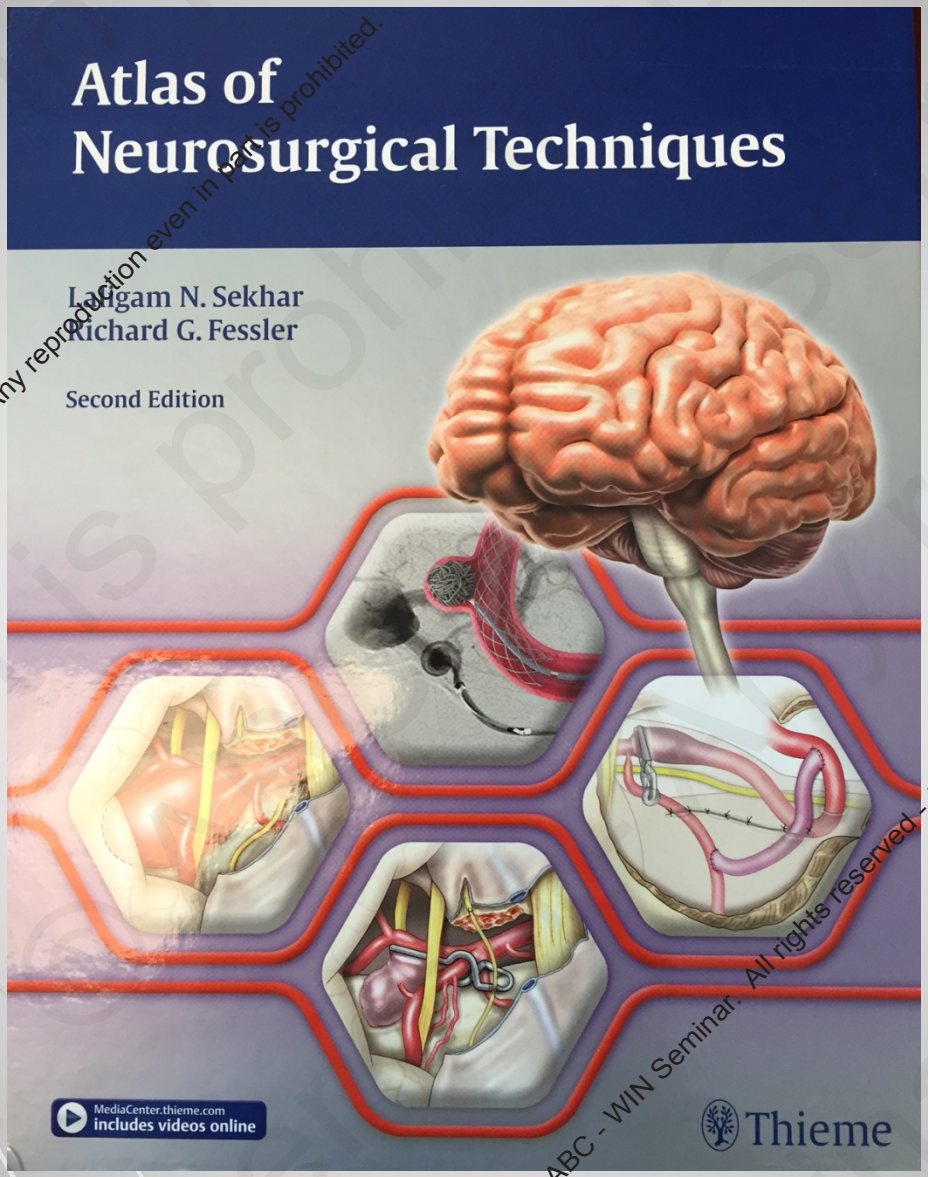
Postoperative Sigmoid Sinus Occlusion;
Pseudo Meningocele
Treatment: Lumbar Drainage fro 5 days;
Anticoagulation for 6 weeks

4 months after surgery





Sinus Has Recanalized



Mildred Cruz

Case 4

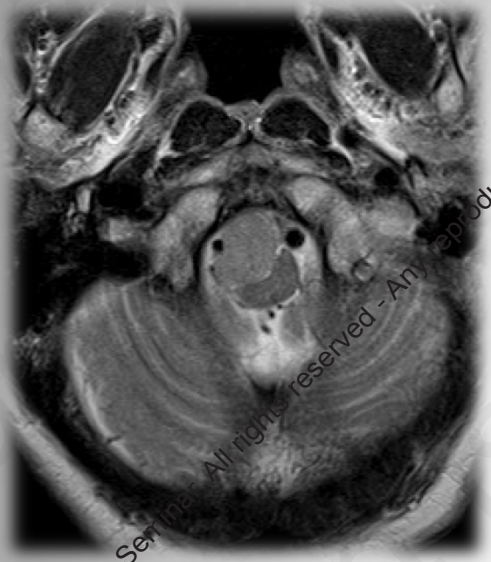
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

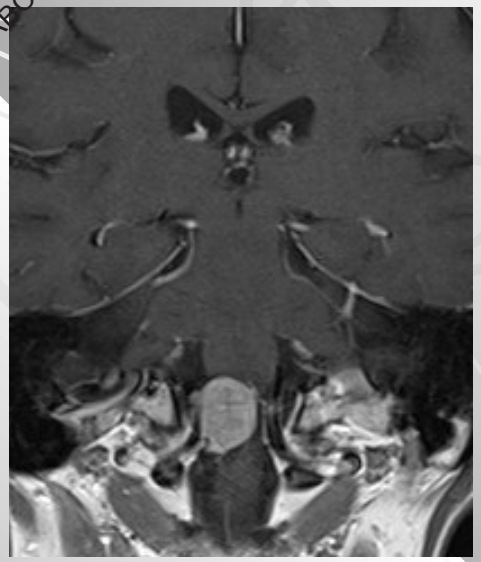
Case Summary

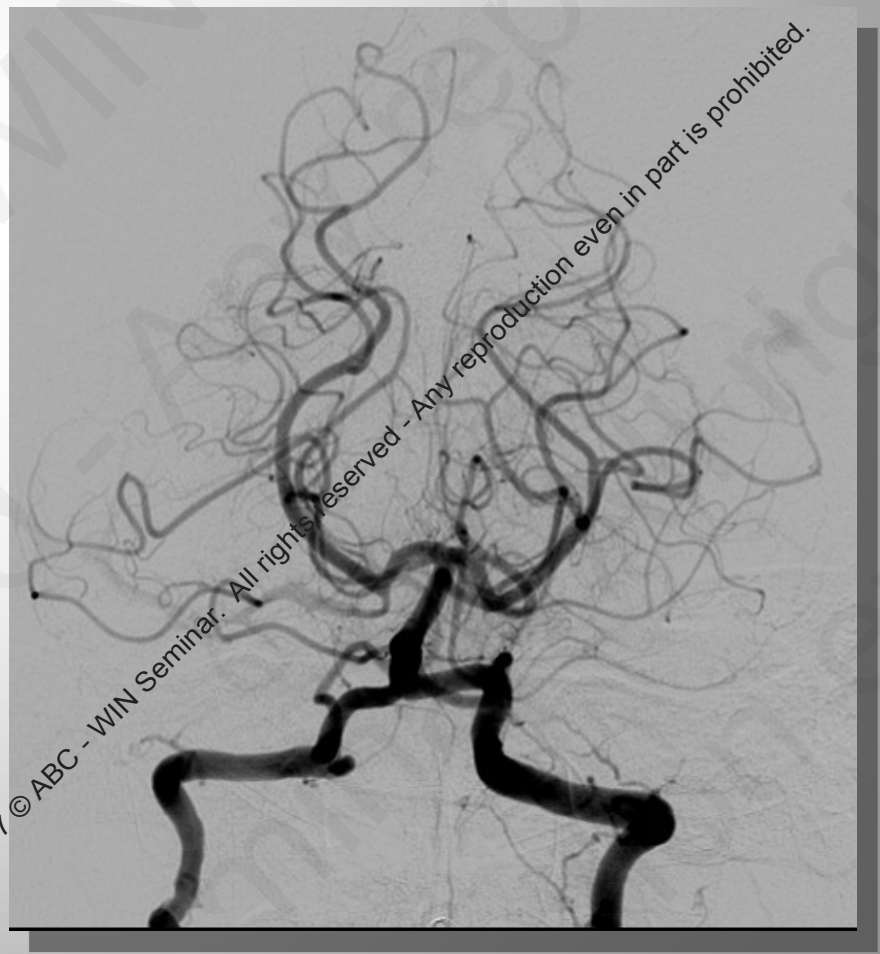
- 70 / Woman
- Progressive Left Arm weakness, Gait Ataxia
- Exam: Bilateral Lower Limb Hyperreflexia
- MRI: large FM Meningioma; Preoperative Embolization
- Surgery: Extreme Lateral Partial Trans condylar Approach; Complete Resection
- Postoperative; All symptoms Resolved, KPS 90

2017 © ABC - WIN Seminar. All rights reserved. Any reproduction even in part is prohibited.

Foramen Magnum Meningioma

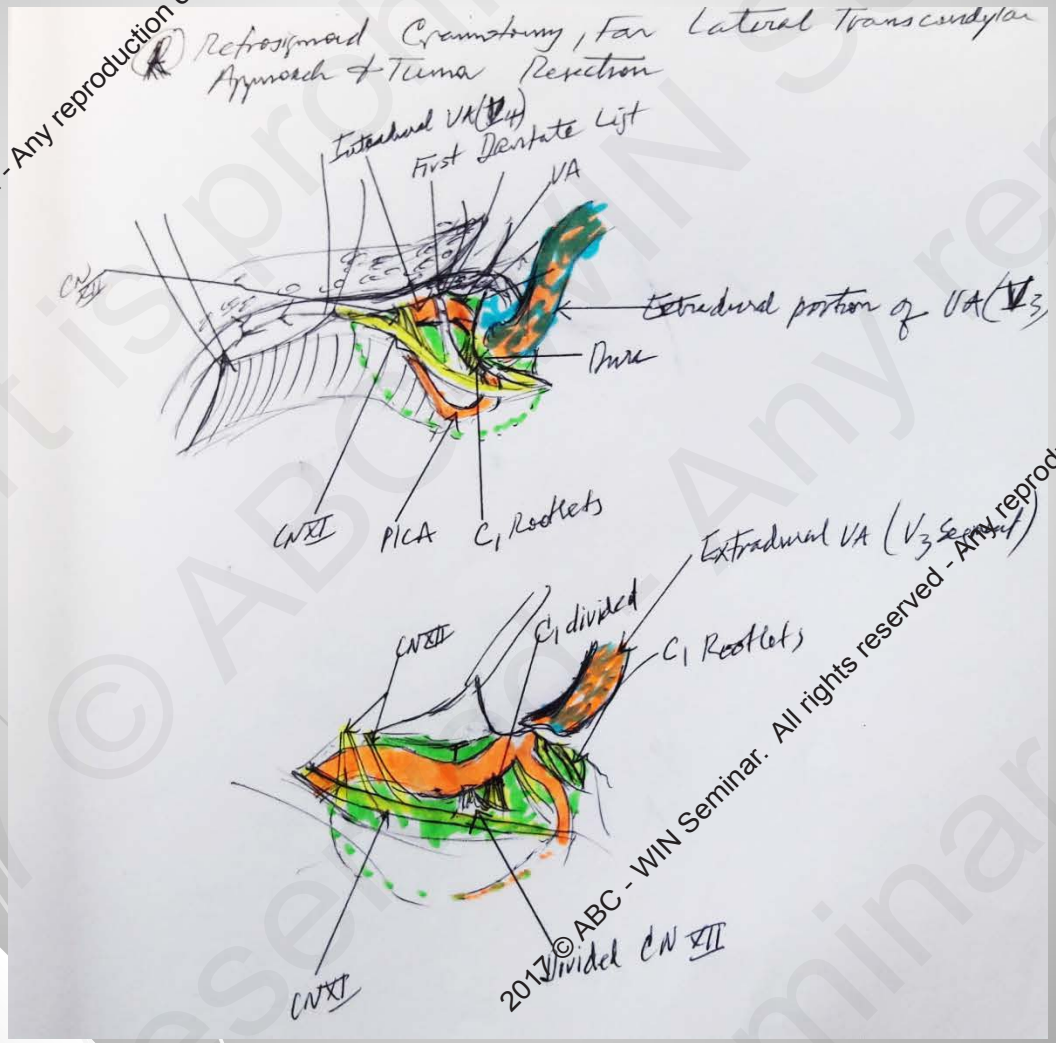




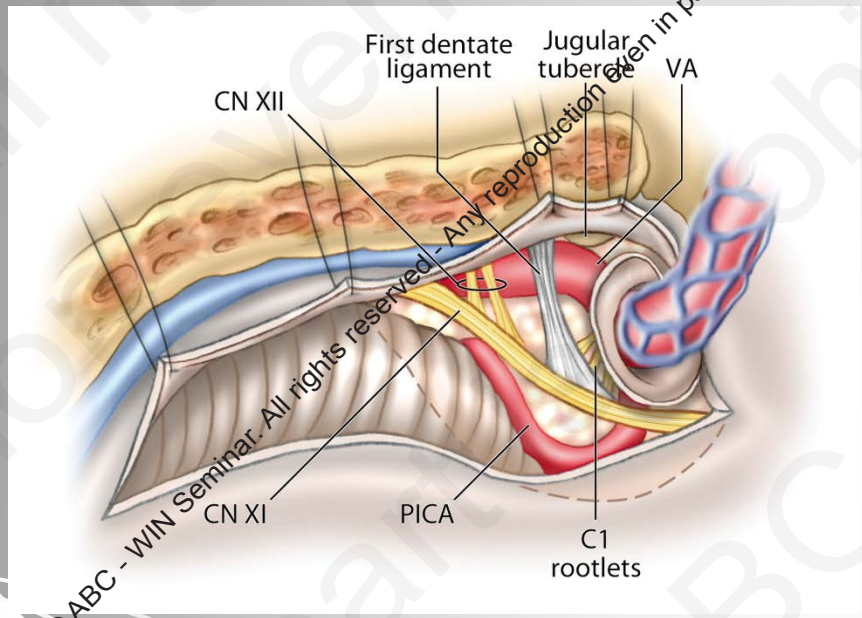


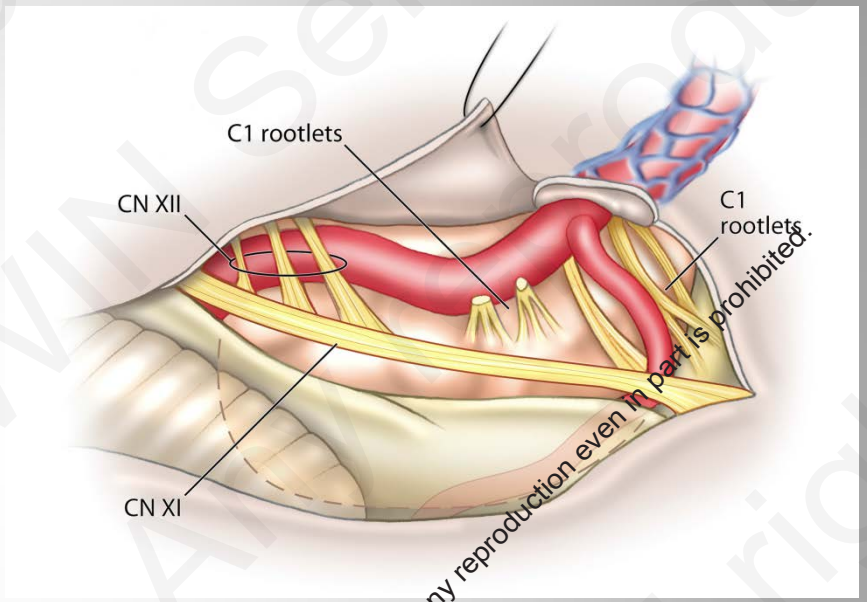
OPERATIVE SKETCH

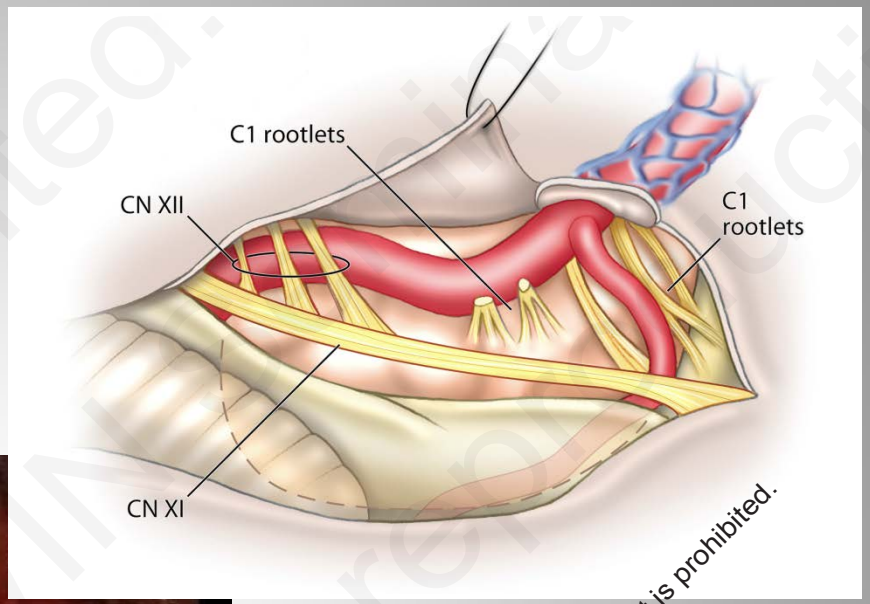
Right retrosigmoid craniotomy and craniectomy, far lateral transcondylar approach, and total microsurgical resection

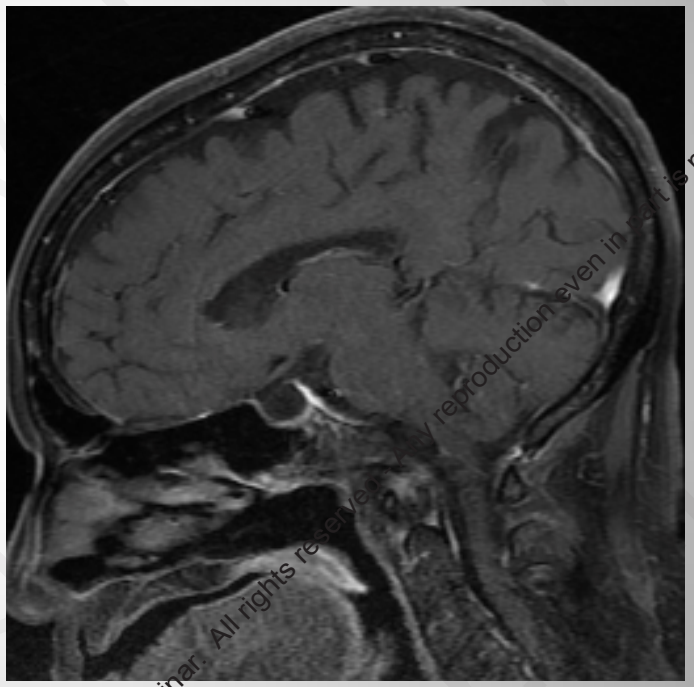


2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.







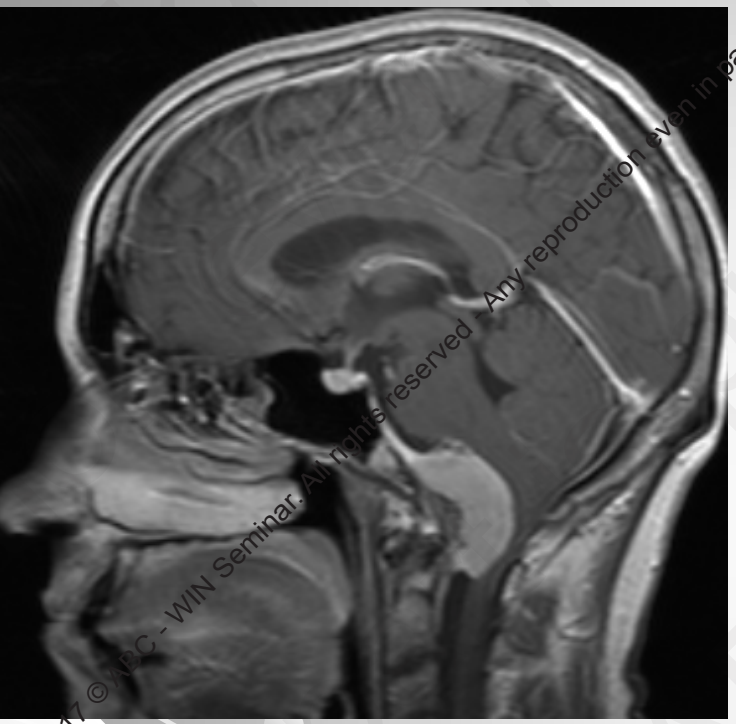


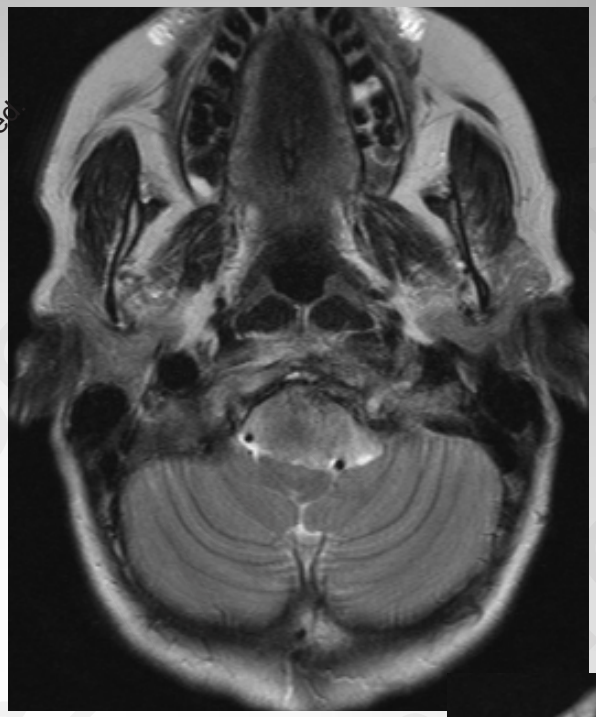
Hilda Polo
H3223413

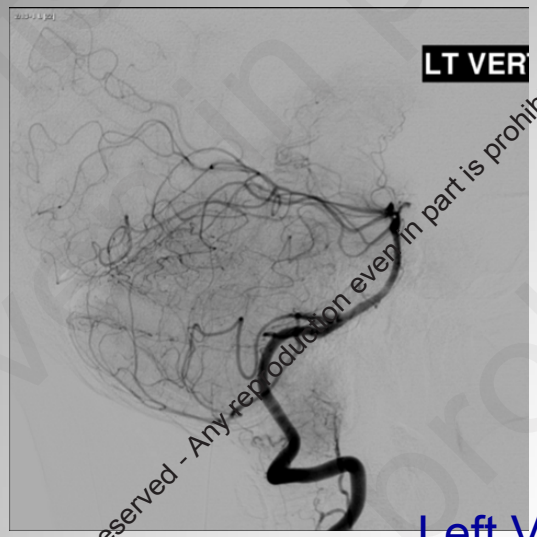
Case 5

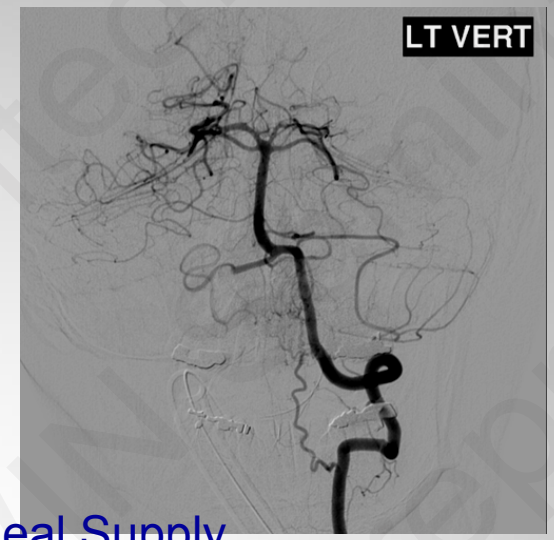
Case Summary: Predominantly Anterior FM Meningioma

- 54 / Woman
- Neck Pain, Bilateral hand Tingling and Numbness
- Exam: Mild Para paresis; Numbness in the Above the Nipple Line, Bilateral arms, left > right
- Extreme Lateral Partial Trans condylar Approach
- Near Total Resection; Small piece left Near the jugular foramen
- Postoperative: Mild Tongue Weakness; Complete resolution

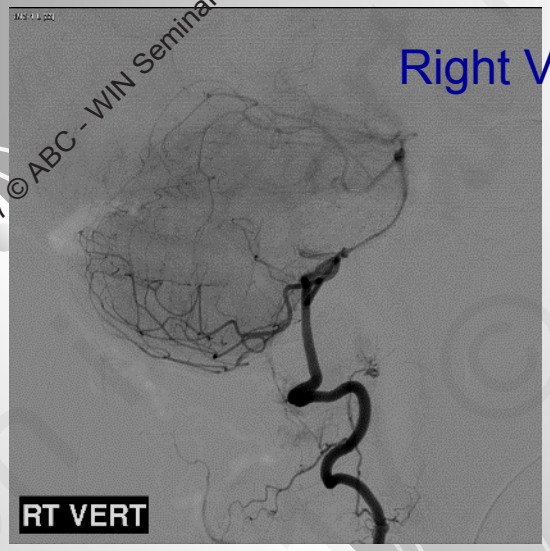




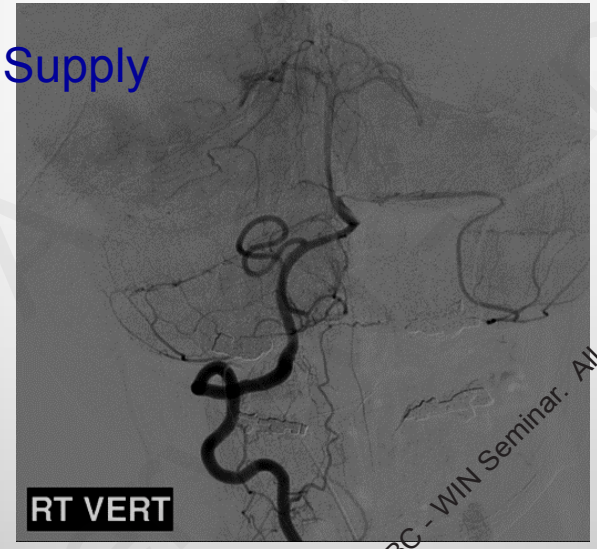


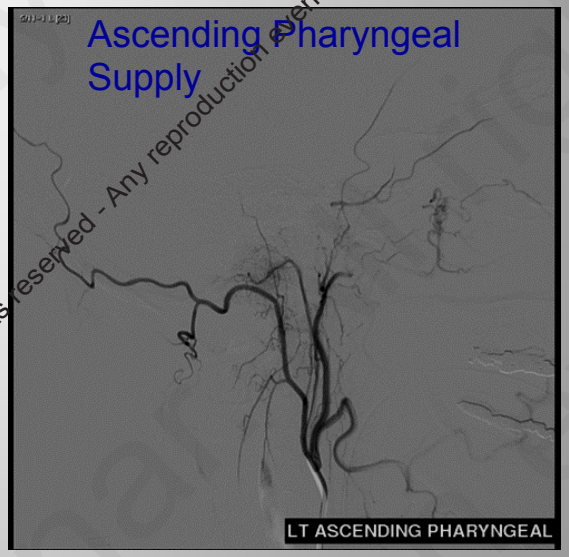


Left VA Meningeal Supply



Right VA Supply





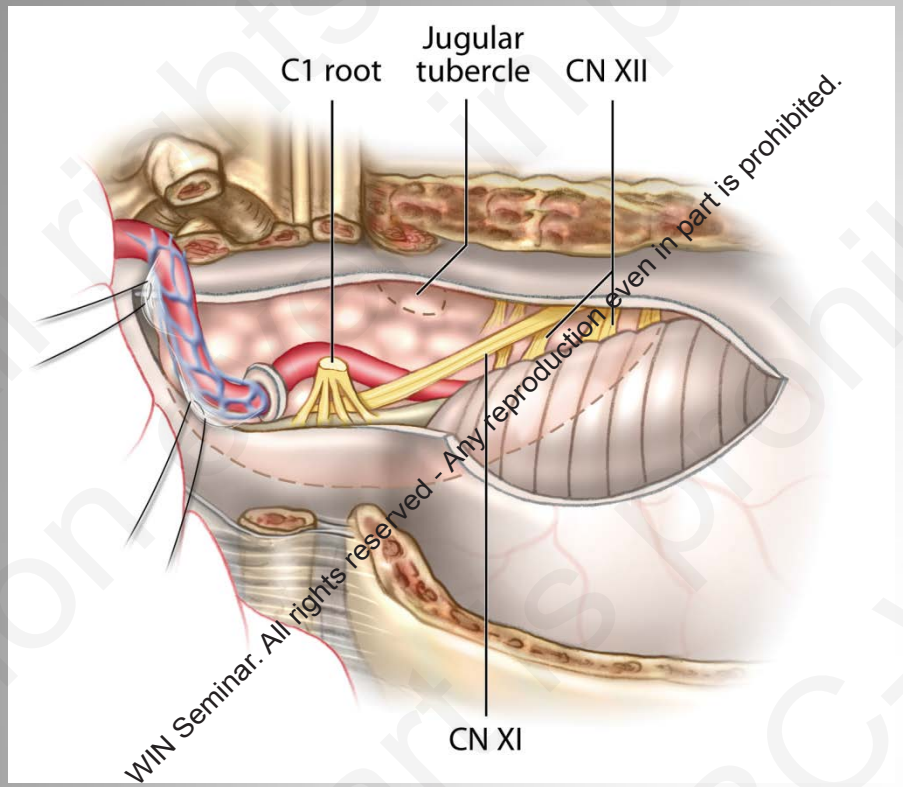
Ascending Pharyngeal Supply

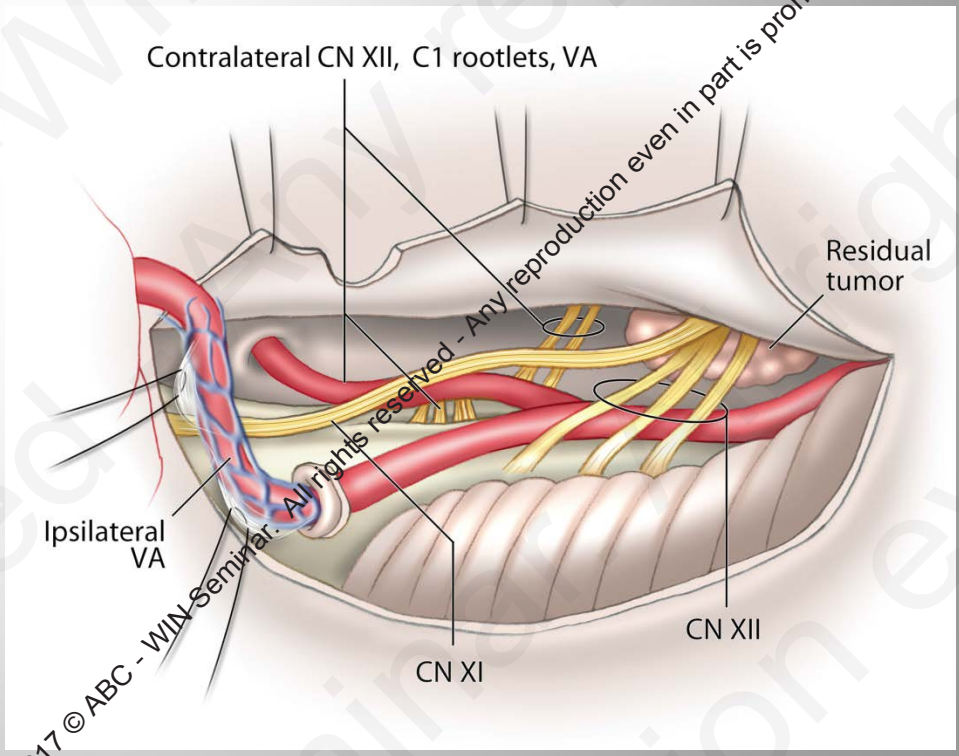
No Embolization Performed

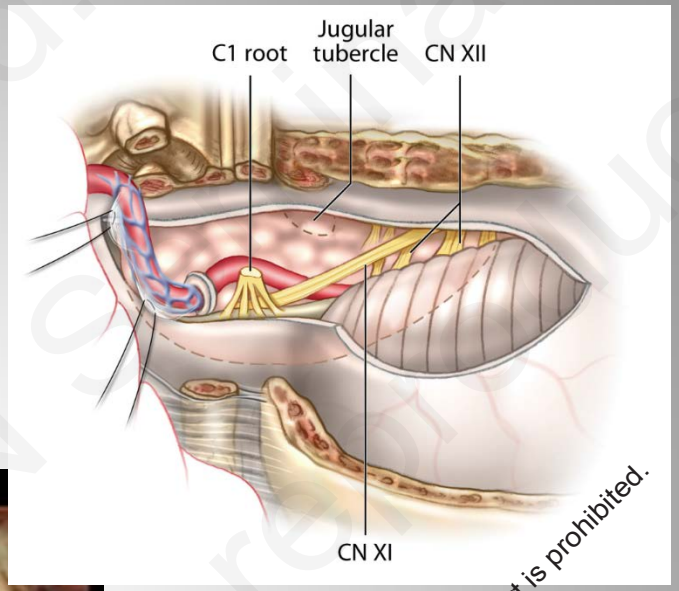
OPERATIVE SKETCH

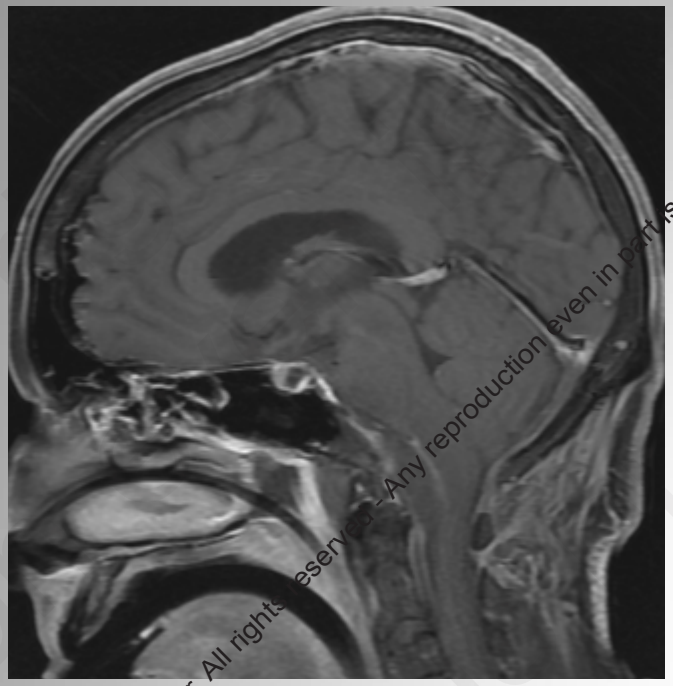
Left-sided extreme lateral approach for retrosigmoid craniotomy and craniectomy, far lateral partial transcondylar approach, C1 laminectomy, vertebral artery transposition, near gross total resection

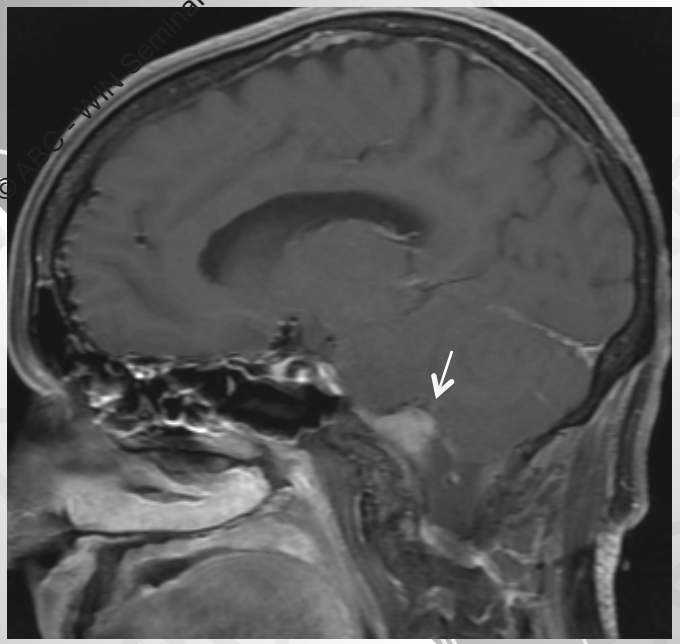
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.


C1 root
Jugular tubercle
CN XII
CN XI
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.


Contralateral CN XII, C1 rootlets, VA
Residual tumor
Ipsilateral VA
CN XII
CN XI
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.







Small Tumor Residue Postoperatively Around the CNs 10 and 11 Gamma Knife Treatment

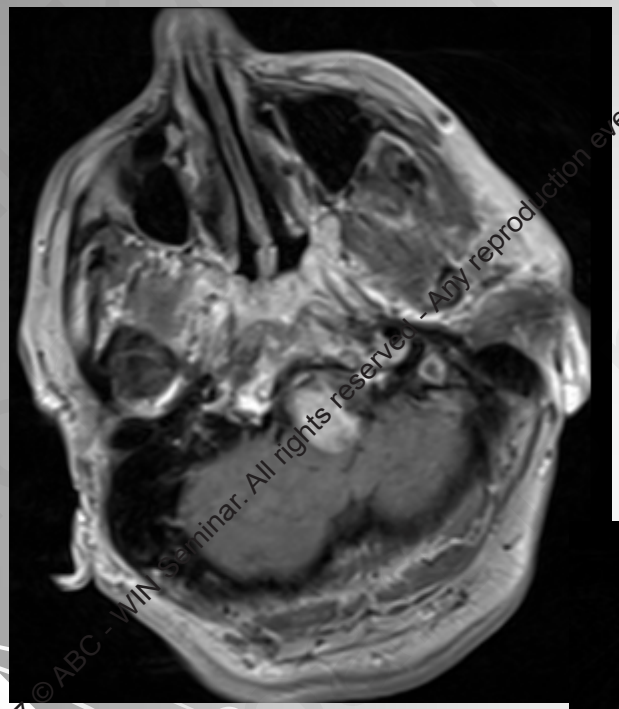
Potential Complications

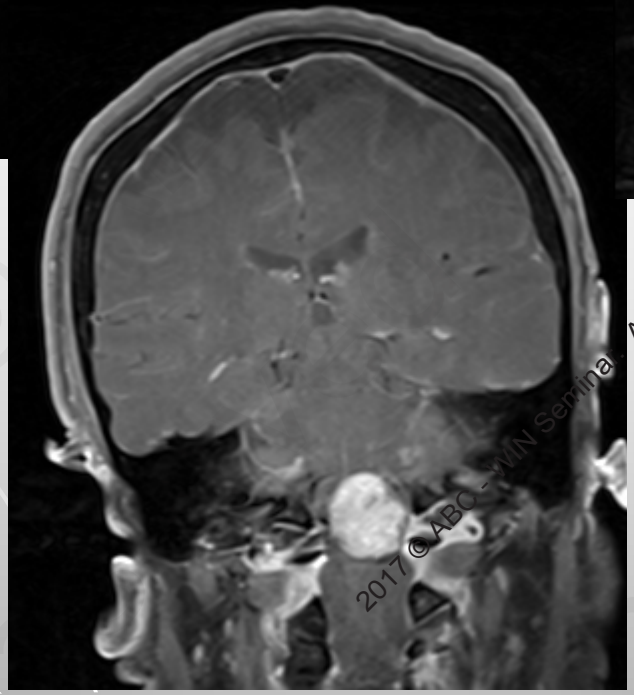
- VA Injury – Rare with care
  Common Sites: V2 to V3 Tortuous Course
  V3 Turn around C1 lateral mass
  Encased By tumor and narrowed
  Collaterals?
  Must be repaired immediately
- Dominant Sinus or Jugular Bulb Injury
- Brain Stem or Spinal Cord Damage
- CN 9,10, 11, 12 Damage
- CSF Leakage
- Infection

JACQUELYN G LONG H3538430

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Vertebral Artery Injury (C 3 Segment)



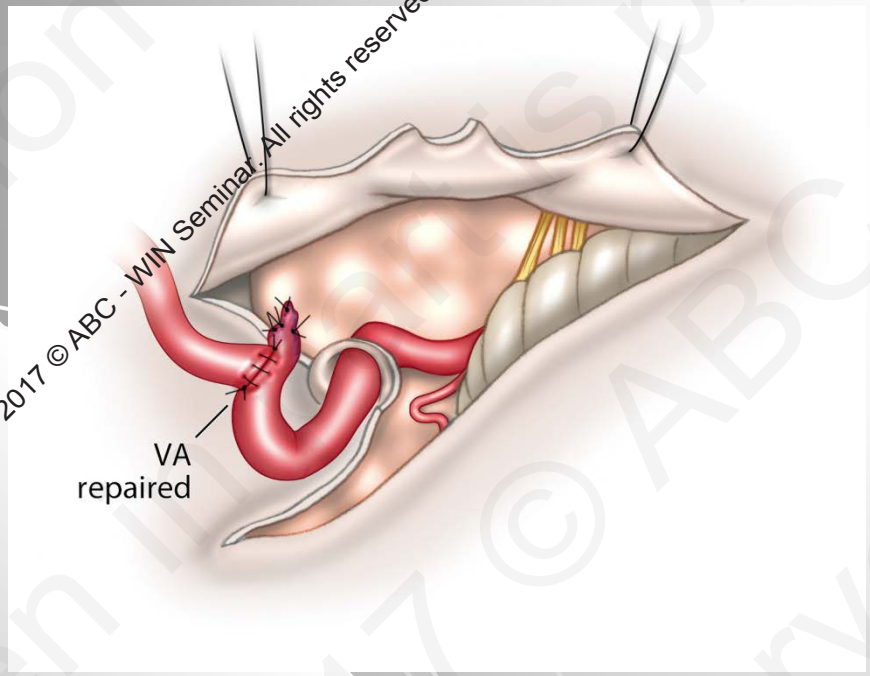


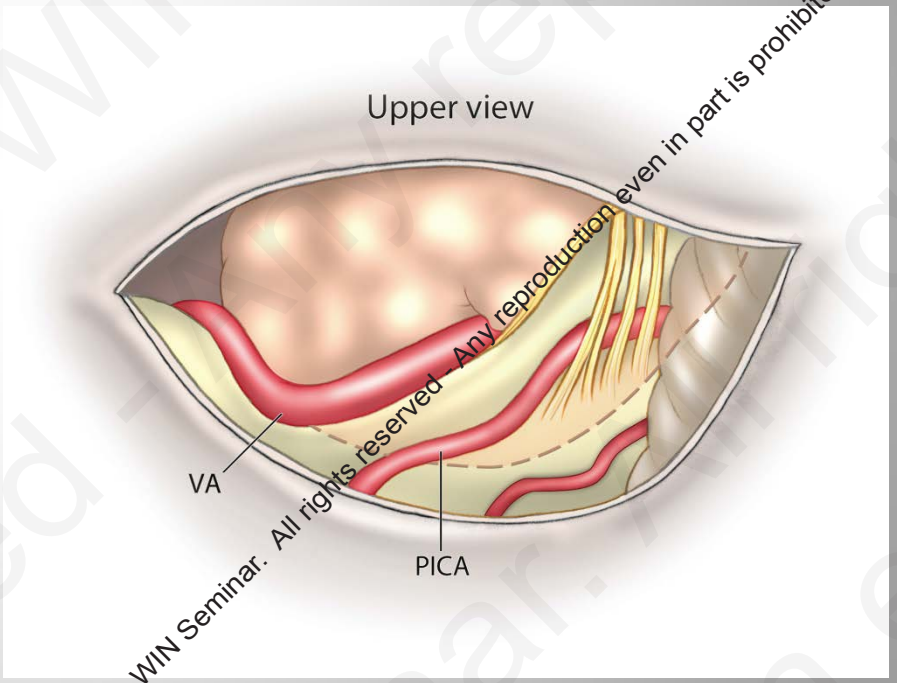
OPERATIVE SKETCH

Left extreme lateral transcondylar approach, Total microsurgical tumor resection, Repair of laceration of the vertebral artery

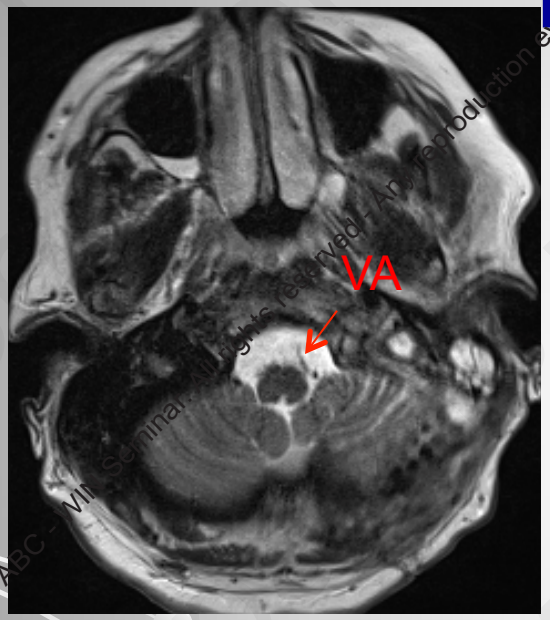
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

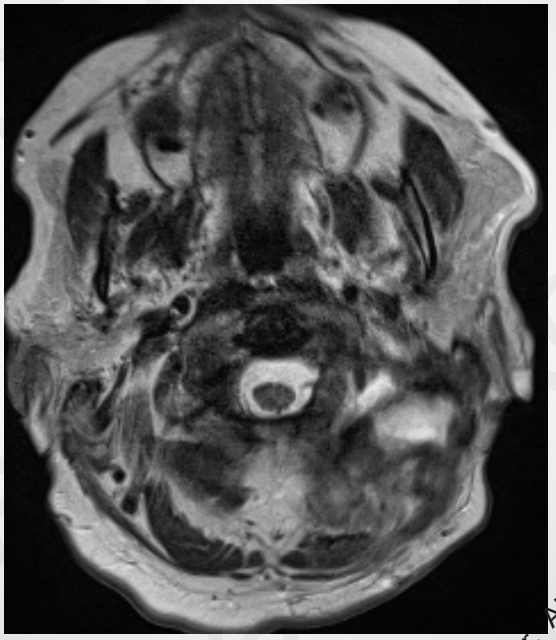
Extreme Lateral Partial Trans Condylar Approach
Hypo plastic VA lacerated and transected during the exposure
Repaired by Resuture after Mobilization

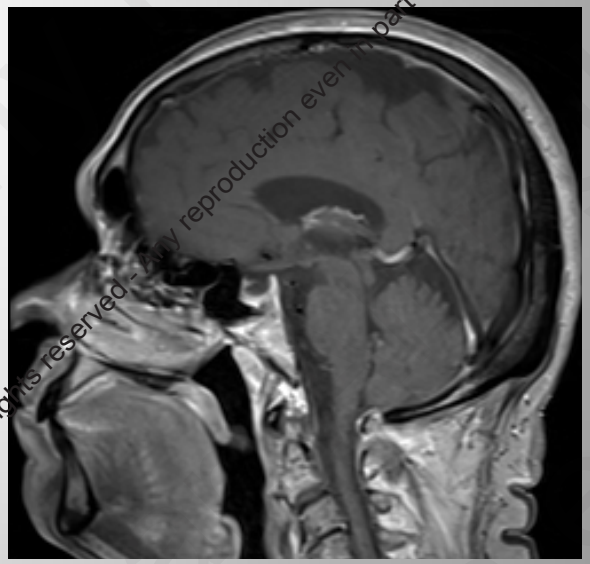




Postoperative MRI
Patient recovered Without Deficit
No recurrence after 4 years



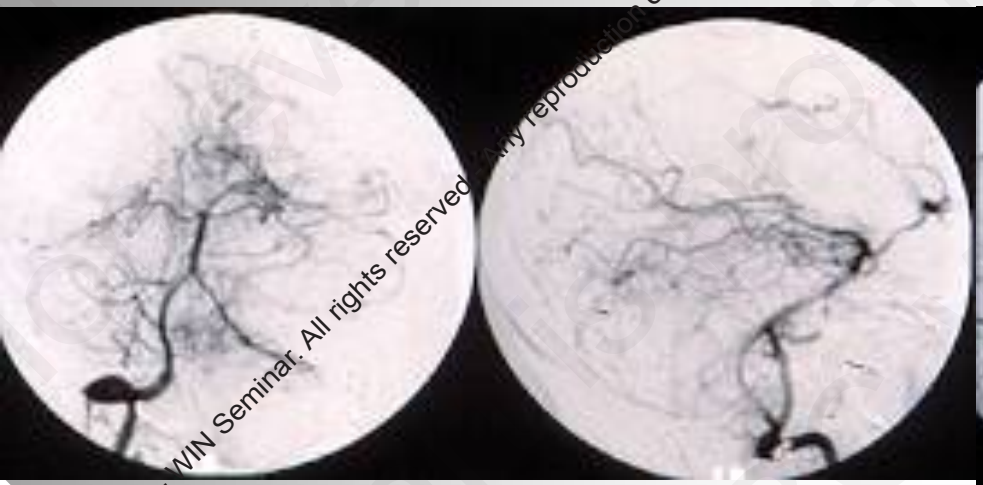


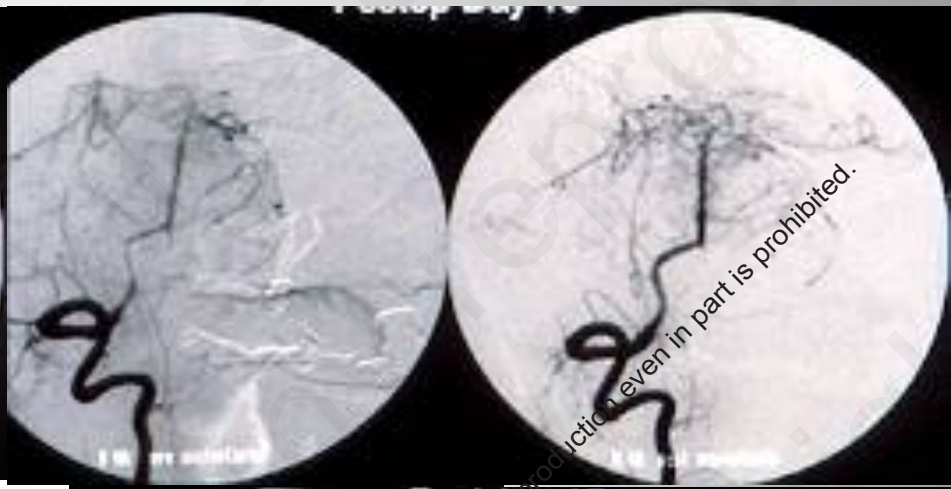


Recurrent Meningioma VA Occluded Previously

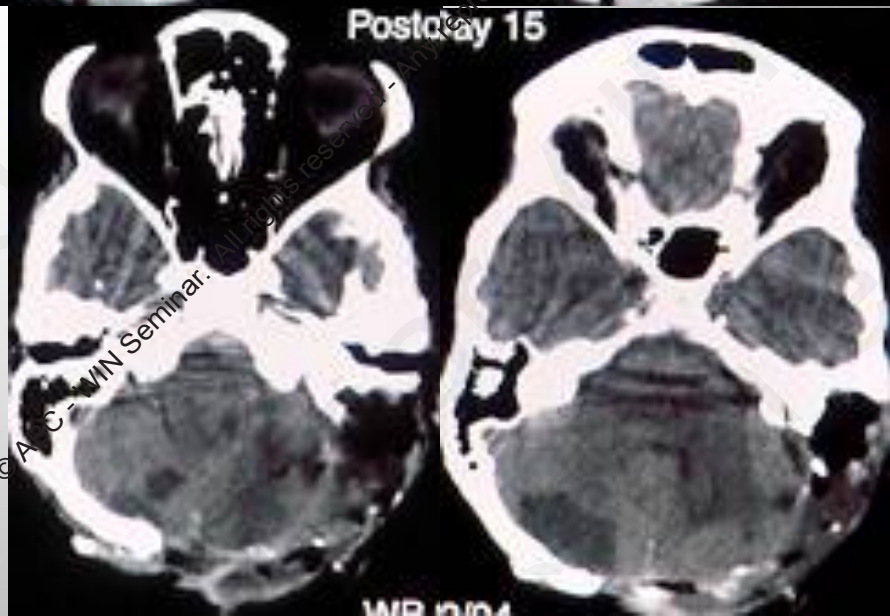
- 65 Year old Lady
  - Previous Partial Tumor Resection
  - Poor Condition, Tracheostomy, Quadriparesis
  - Transferred For Further Treatment
  - Complete Tumor Resection

Postoperative Vasospasm

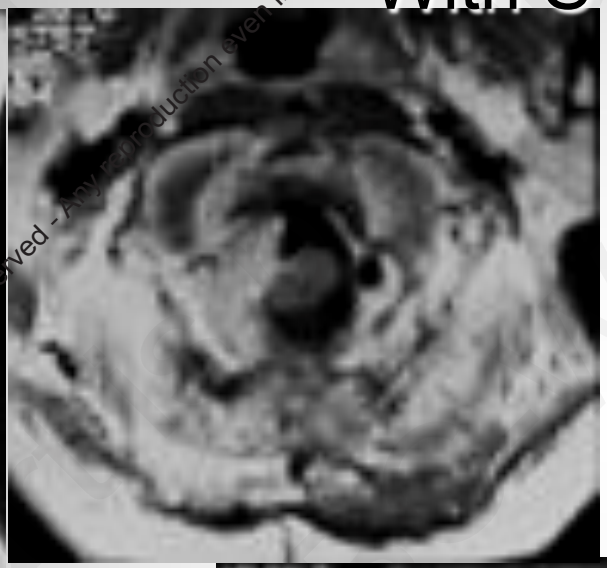


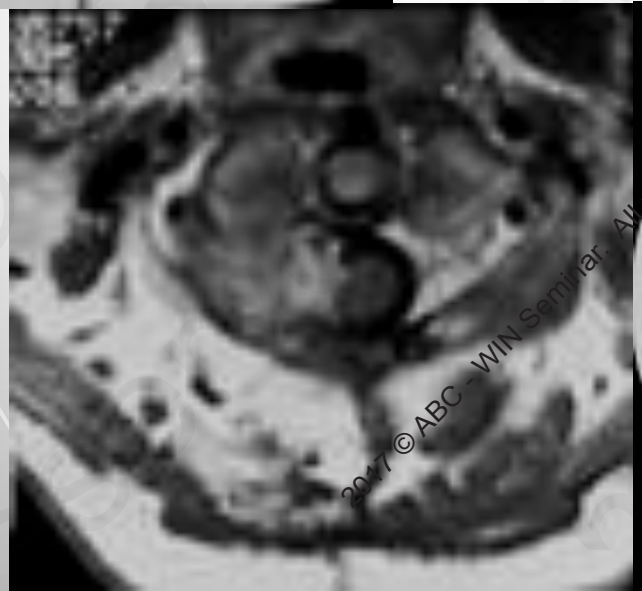


- Severe Deterioration On Postop Day 13
- CT Scan Bilateral cerebellar Infarcts Postop Day 15
- Cerebral Vasospasm Discovered, Angioplasty on Postop Day 16
- Patient Did not Improve



Recurrent Foramen Magnum Meningioma: VA encased by scar and tumor; Replacement With SVG





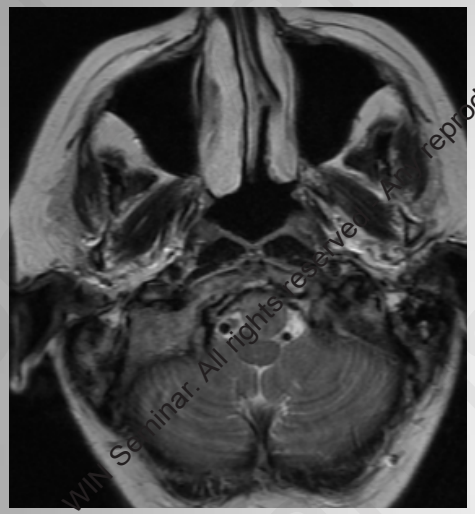
Complete Tumor Resection
SVG in Place

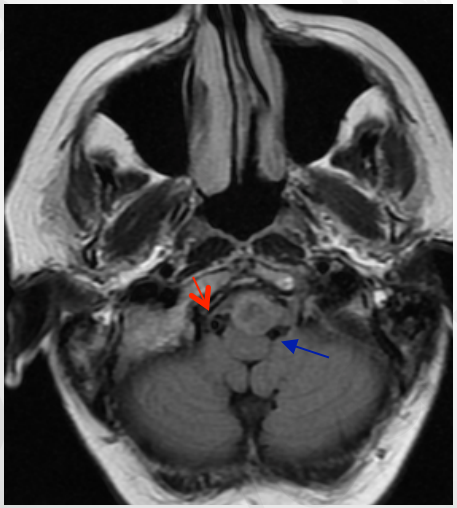
KAREN PHILLIPS WALSH 63/F
H3605012

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

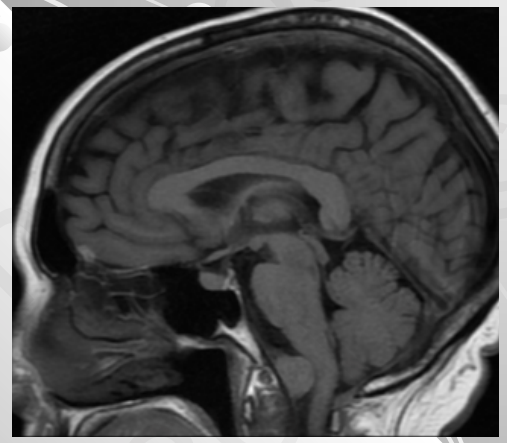
OCCIPITOCERVICAL INSTABILITY

63/F
Asymptomatic growth of
Meningioma Over a 7 year Period
NO Neuro Deficits
Preop KPS 80
No preoperative Embolization



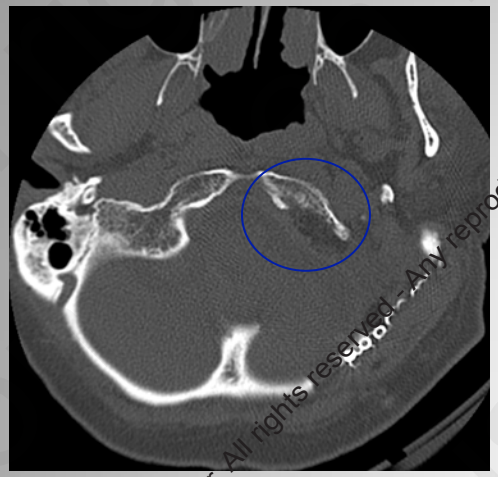


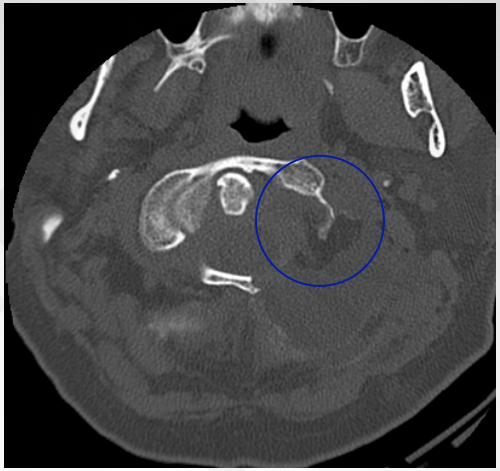
- Approach from Left in view of brainstem distorted and tilted to the Left Side
- But Tumor extended across to the Right side, necessitating a more anterior approach, with more Condyle and C1 resection



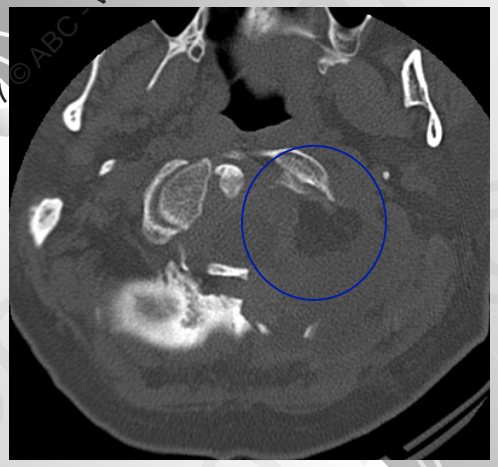
Left Extreme lateral trans condylar approach, Left Retrosigmoid craniotomy, Mastoidectomy, C1 laminectomy, Complete Tumor Removal

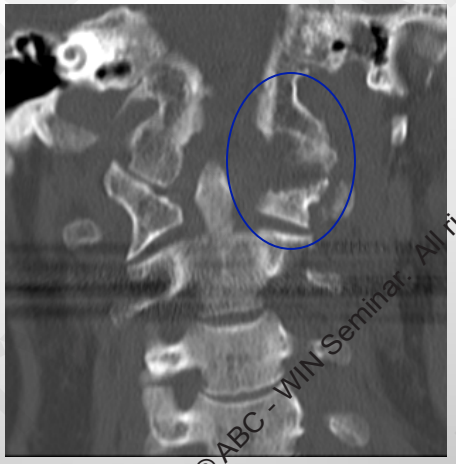
Immediate Postop CT Scan showing excessive resection of Left occipital condyle and C1 lateral mass causing Severe Persisting Neck Pain and Tilt





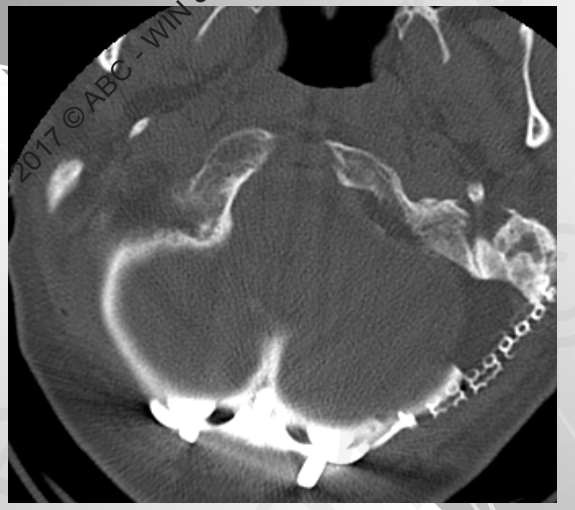
Neck Tilt Seen





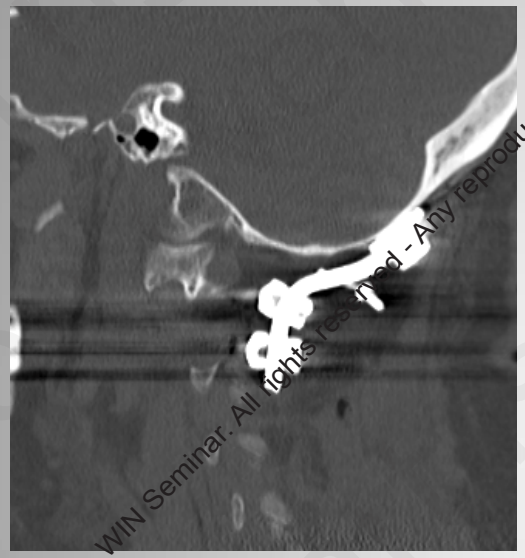
Notice the Extent of OC and C1 lateral Mass removal

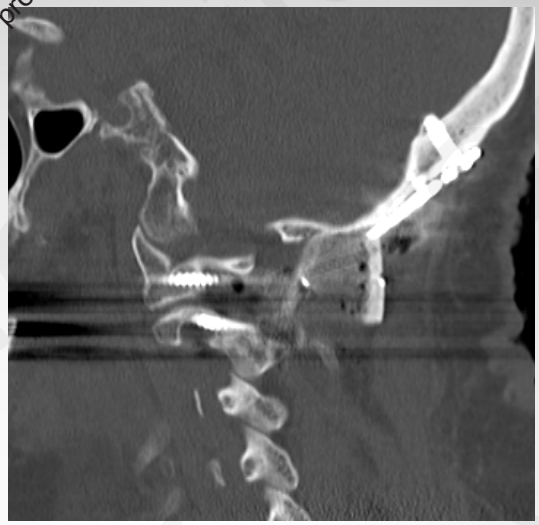
Postop X ray & CT showing Occipito-Cervical fusion

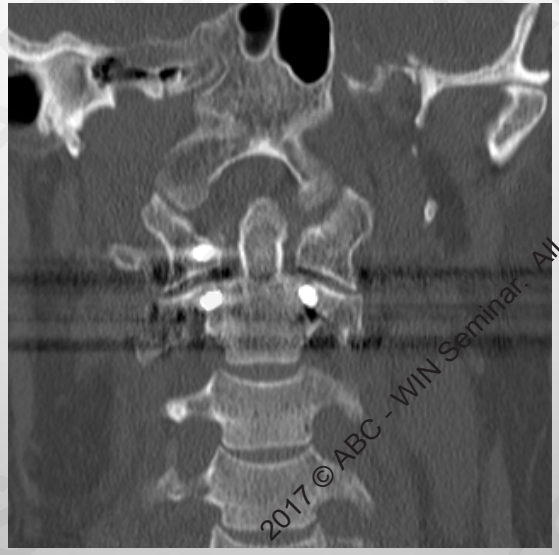


Occipito Cervical Fusion 1 month after the Original Surgery
Symptoms Completely Resolved

Postop CT C –Spine showing Occipito-Cervical fusion







Neck Symptoms Relieved completely
Gross total resection
Postop KPS 90
WHO I
No recurrence
F/U 2 Yrs

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

Hemangioblastoma

- Two Cases
- One was in a Patient with Von Hippel Lindau Disease

> Patient with VHL: Multiple tumors and recurrences within a short time

> Died Eventually, after surgery due to brainstem edema

- The Second Patient……

2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

ALI NAWAB H3672488

(Preop partial embolization)

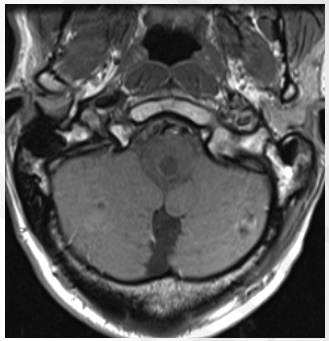
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

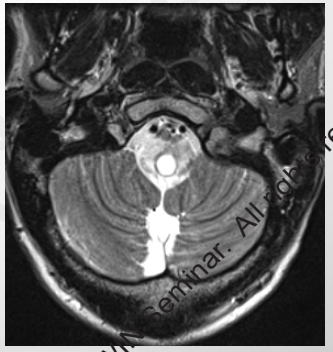
Large Medullary and Cervical Cord Intrinsic Hemangioblastoma

- 37/M
- Progressive R hemiparesis – 6 months
- Exam: R hemiparesis 4/5; Bilateral Hyperreflexia
- KPS 60
- MRI: Cervicomedullary Hemangioblastoma
- Angiogram – Fed by Anterior and Lateral Spinal Arteries
- Embolization
  - > PVA embolization of feeders from Lateral Spinal Artery
  - > Not really Helpful

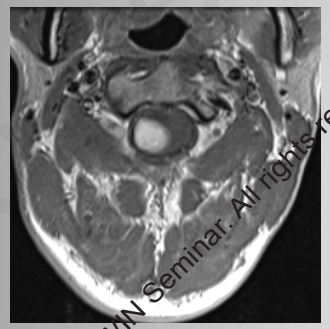
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

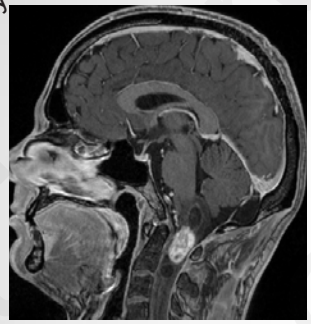
Preop MRI plain

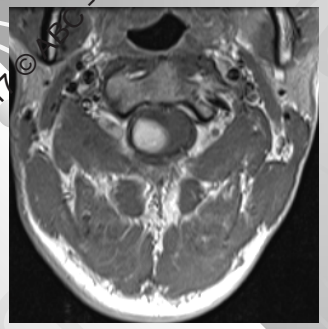


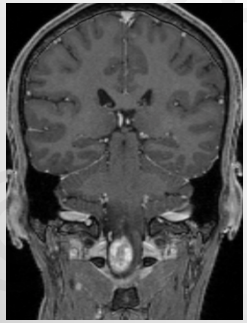


Preop MRI contrast

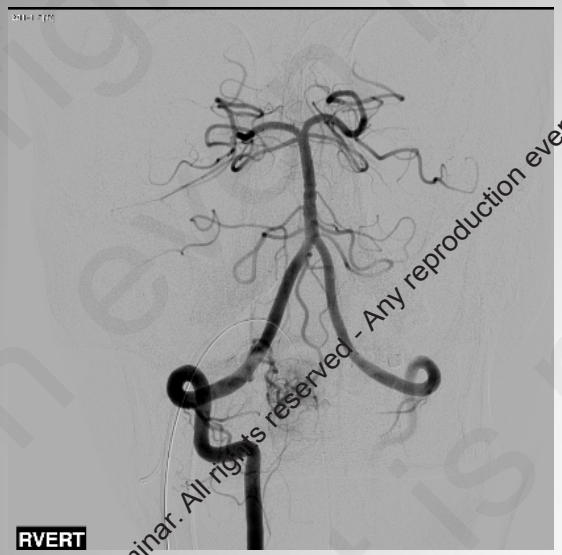


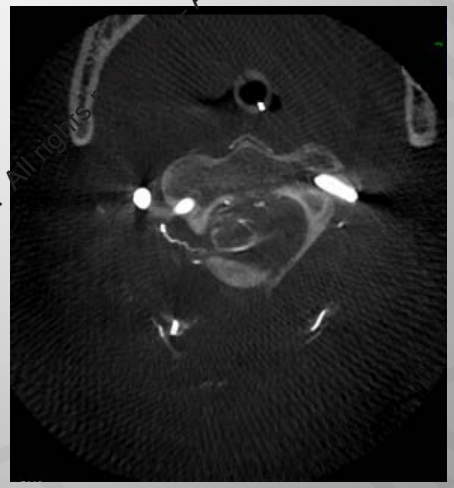




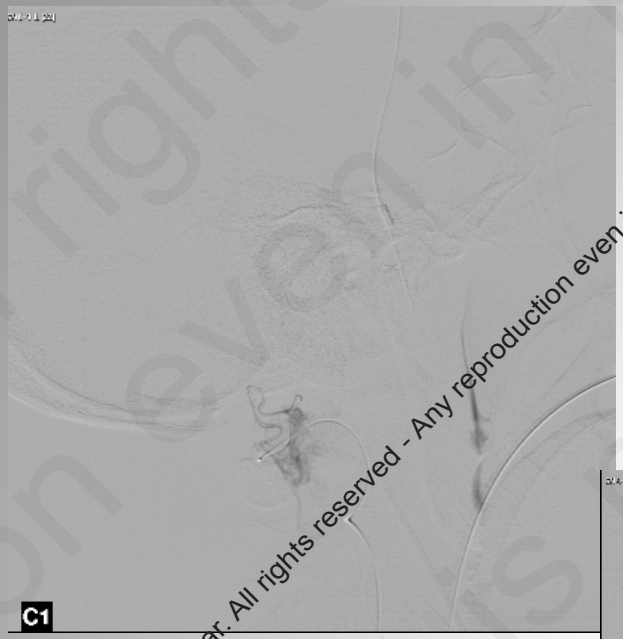


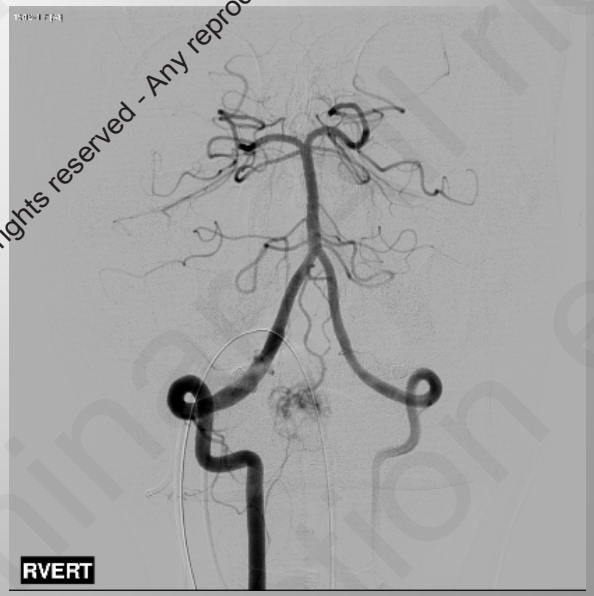
Preop IADSA





Embolization of Lateral Spinal Artery



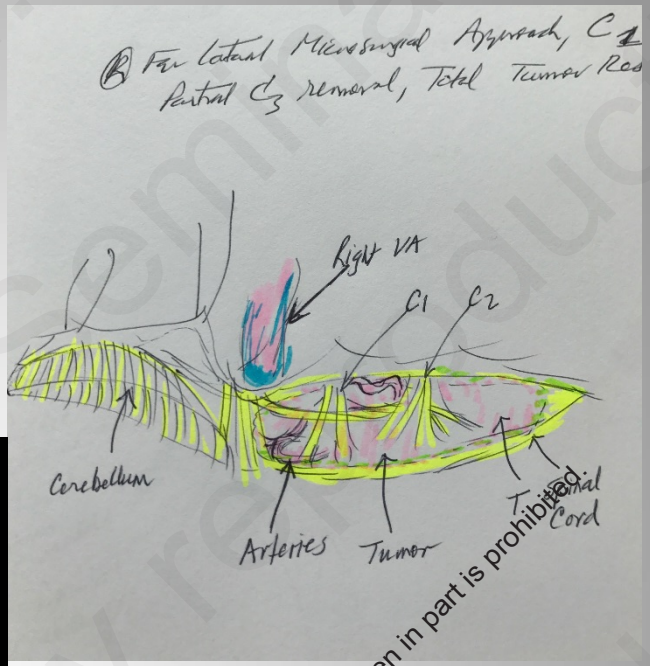


Surgery

- Far Lateral Approach
- C1-3 Laminectomy
- Lateral Decubitus Position with Right Side Up

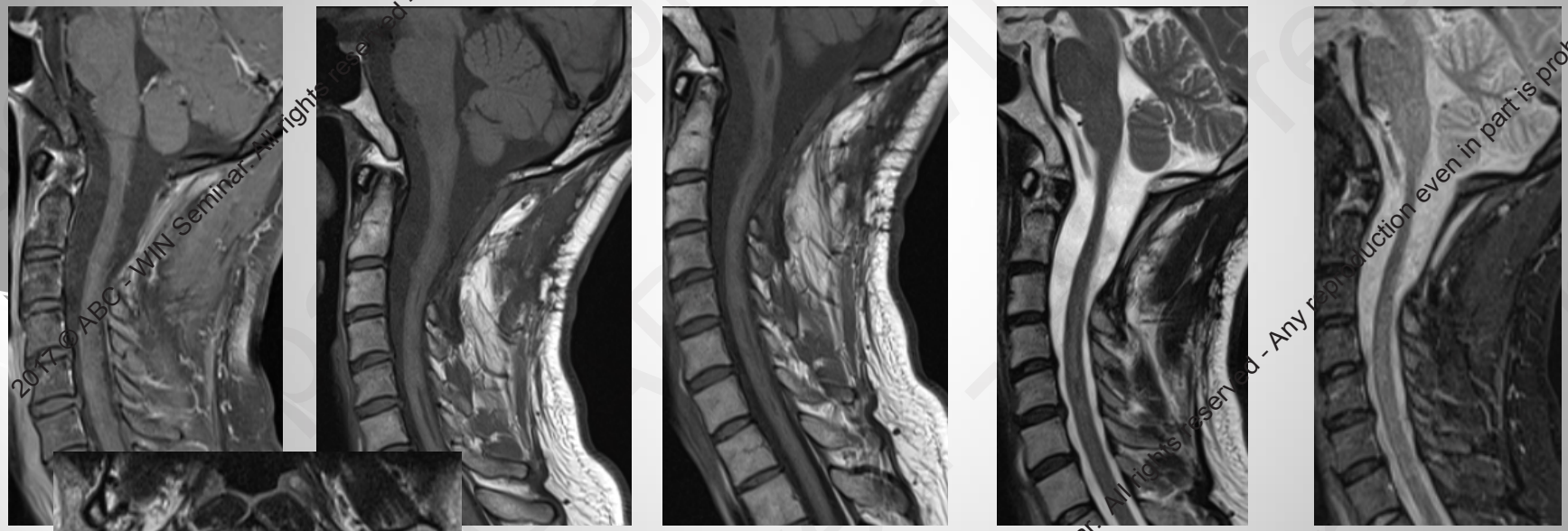
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

MICROSURGICAL EXCISION OF CERVICOMEDULLARY HEMANGIOBLASTOMA



Follow Up MRI 1/6/2016 (after 23 months)

Postop Comp:
hyponatremia and postural hypotension
KPS 90
F/U 23 months



Nearly Complete Recovery
Mild Right sided weakness
Working full time as a Computer Engineer

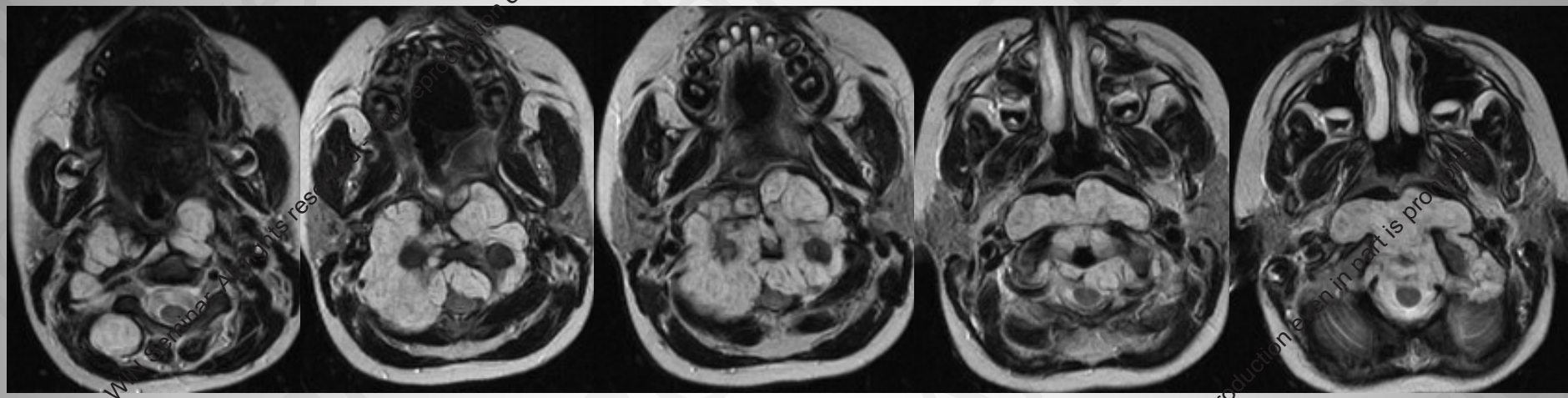
Chordoma

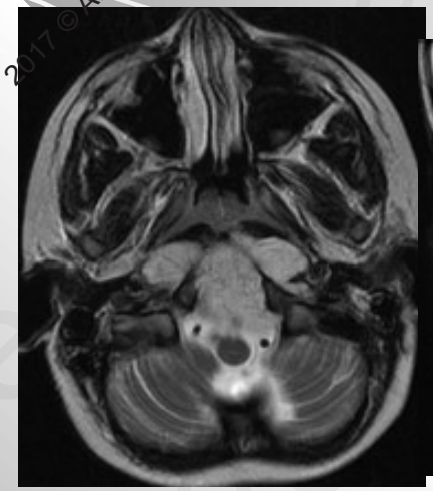
- Foramen Magnum Chordomas are about 1/4th of Cranial Chordomas
- One or Both VAs may be encased
- Extreme Lateral, Complete Trans Condylar Approach is Used for Resection
- Generally, the Vertebral Artery Can be Dissected Free of Tumor

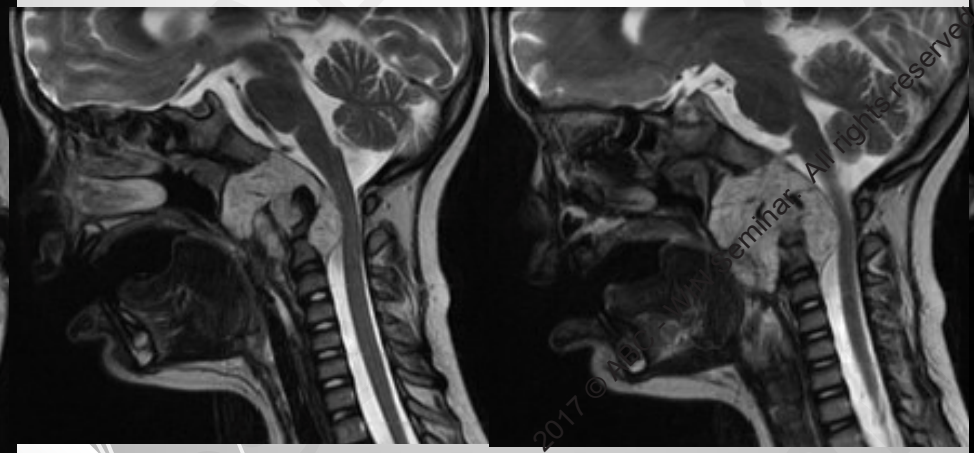
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.

5y/o Girl, Severe neck and shoulder pain, and Inability to keep head up straight, Inability to eat, Dragging of both feet, particularly the right side

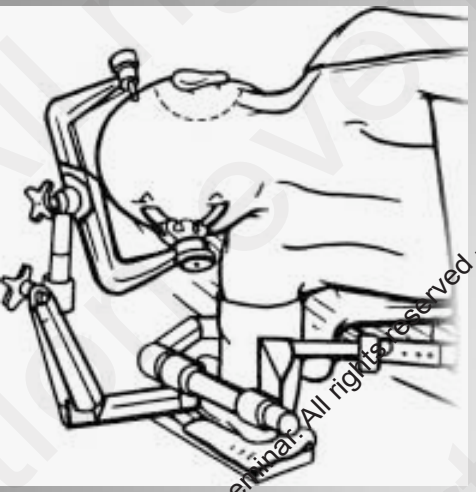
Sekhar Score: 22 , Karnofsky : 40

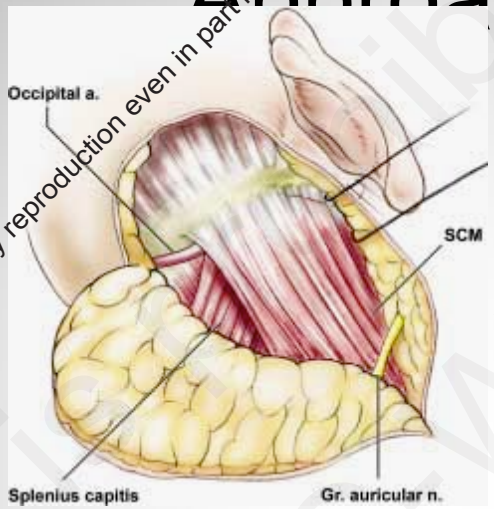


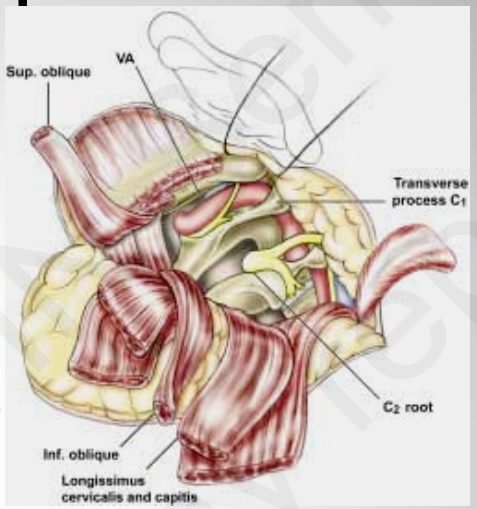


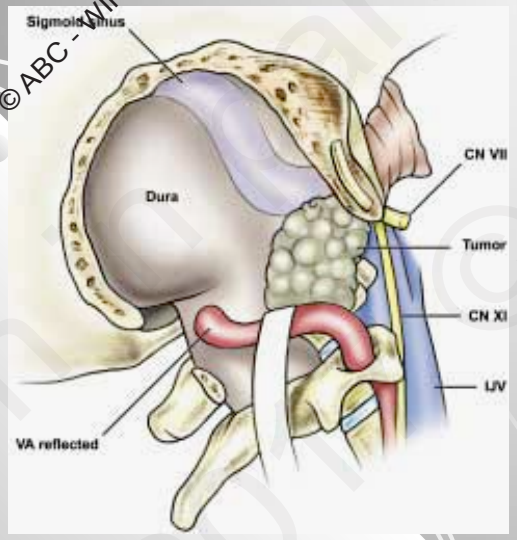


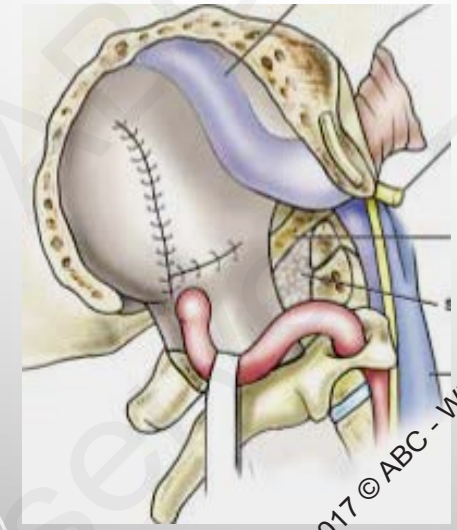
Extreme Lateral Trans Condylar Approach



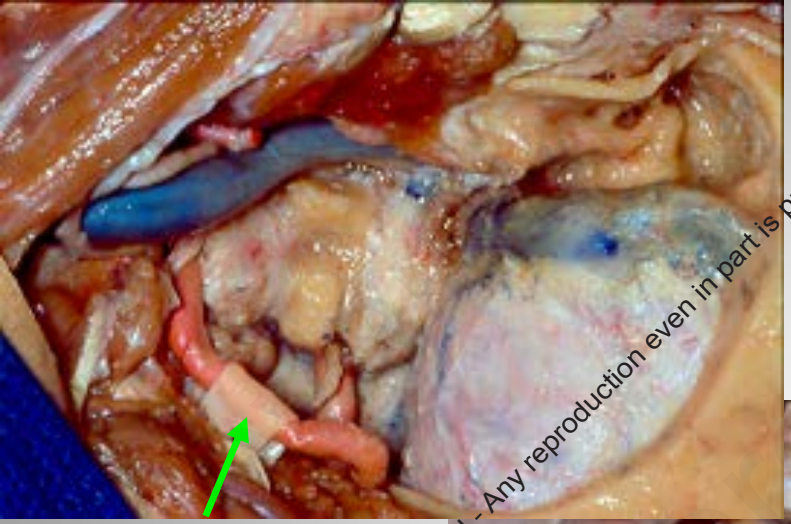




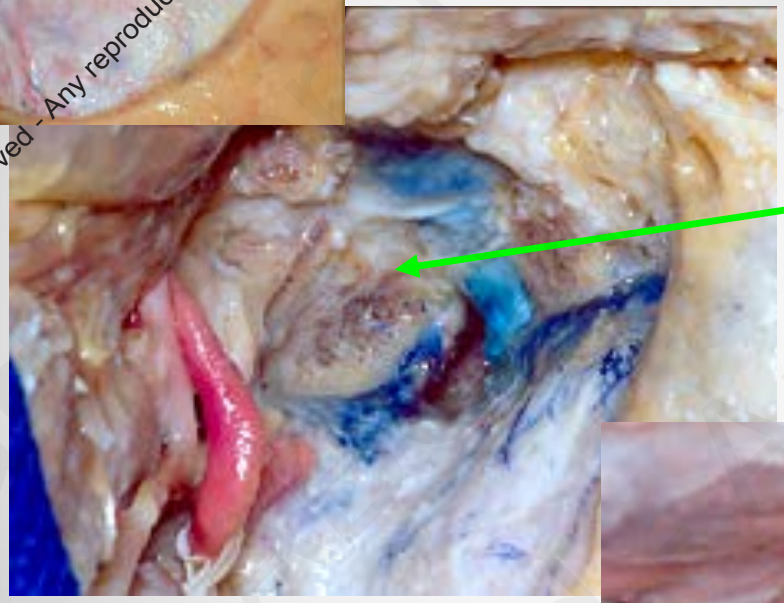




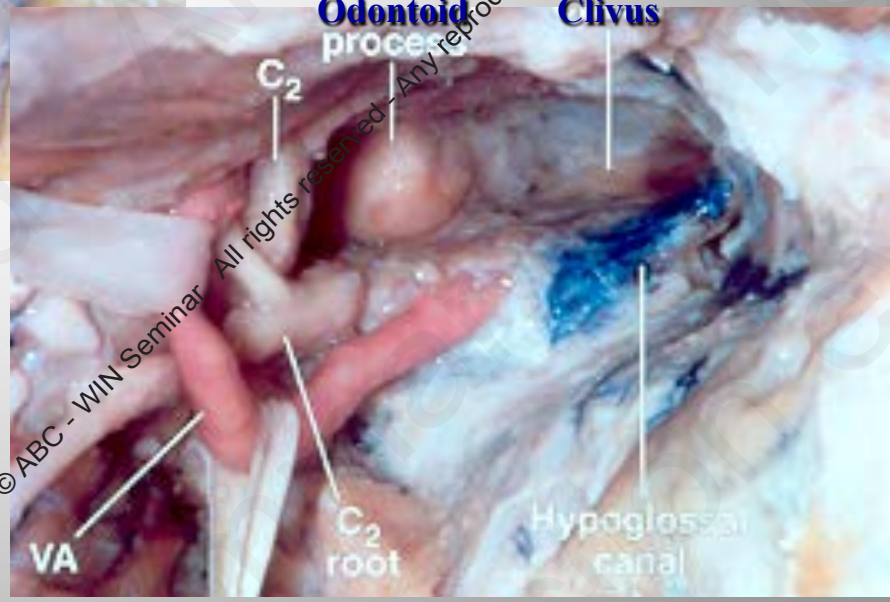
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.
2017 © ABC - WIN Seminar. All rights reserved - Any reproduction even in part is prohibited.



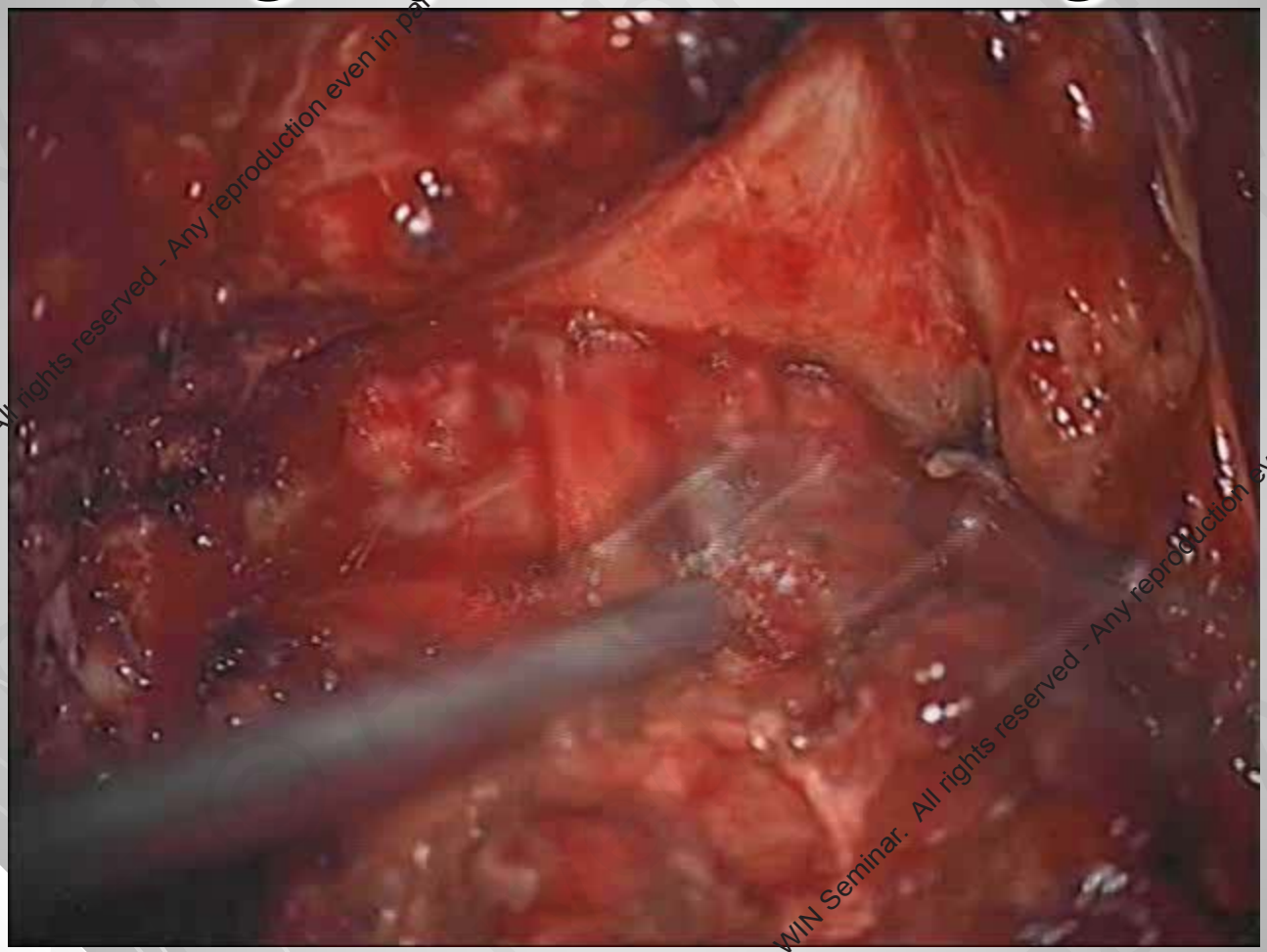
VA Displaced



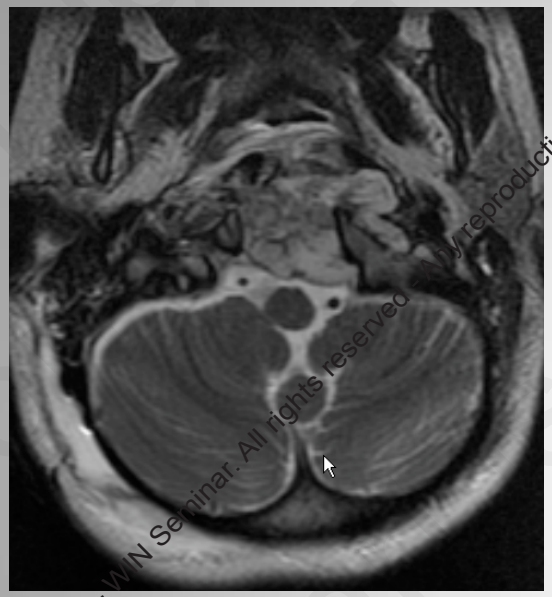
Condyle Drilled

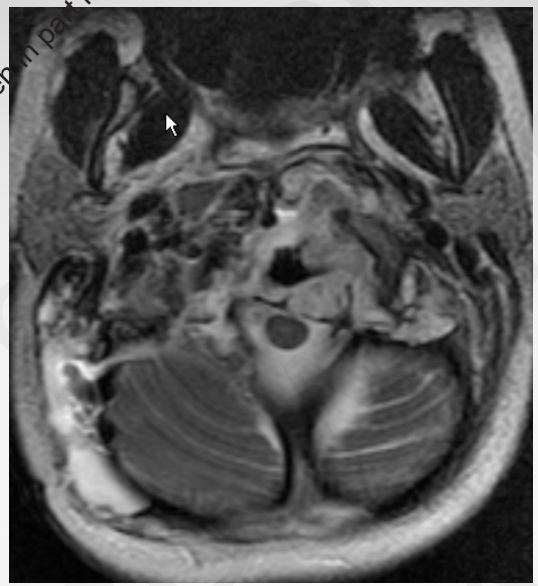


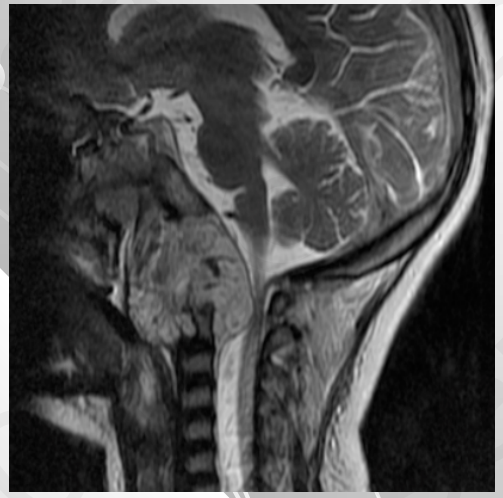
Surgery From the right



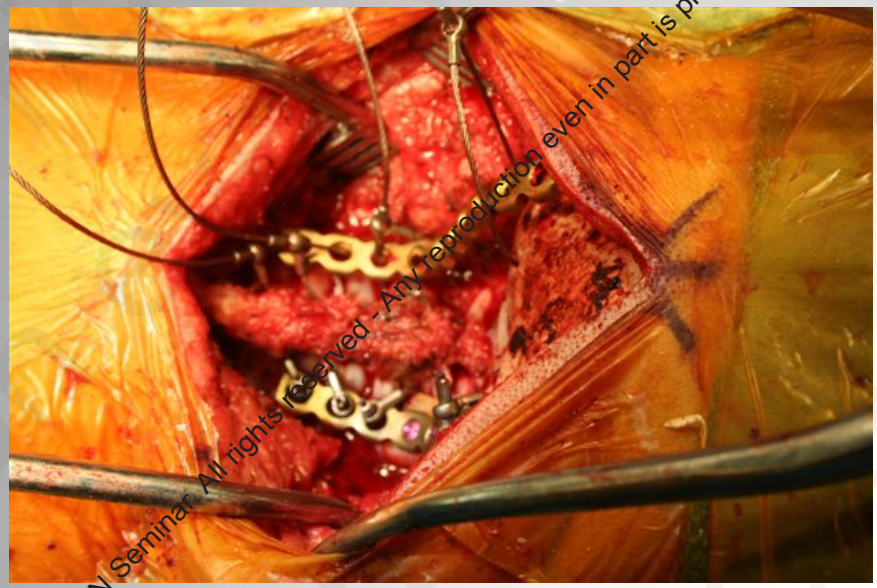
Post First Resection

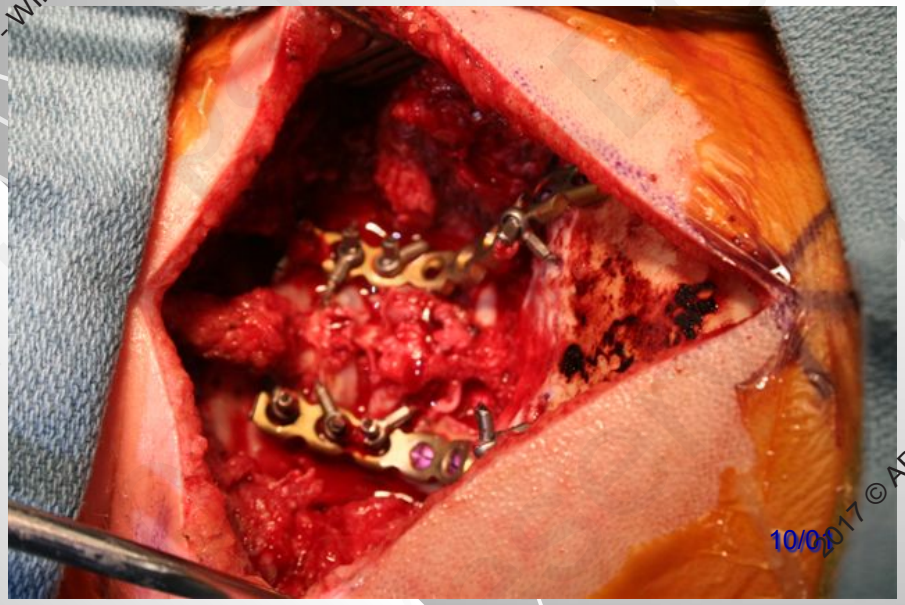


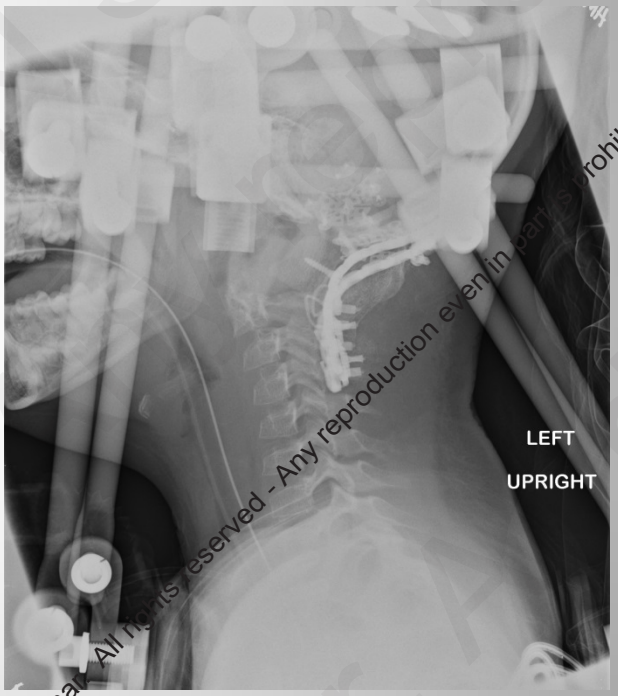




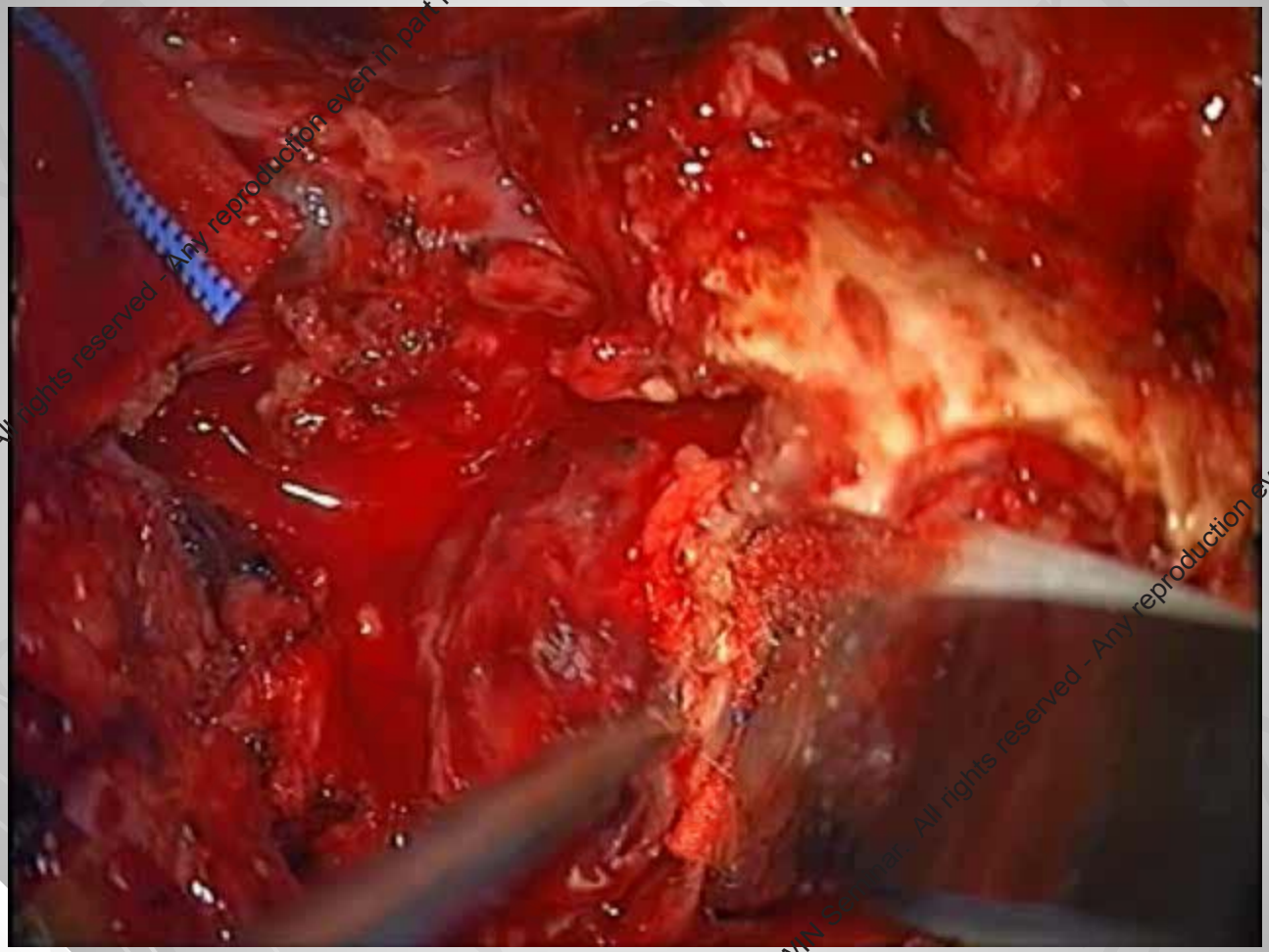
Occiput to C2-3 Fusion



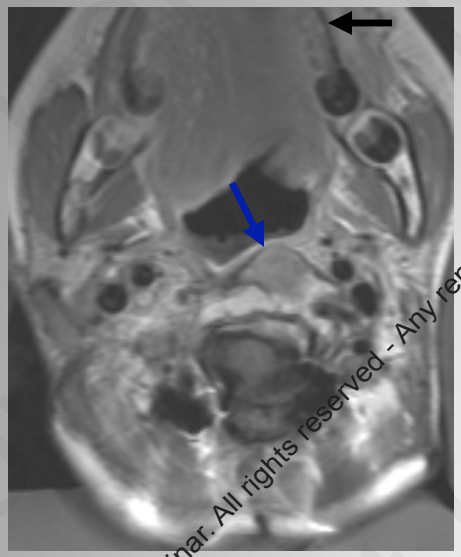


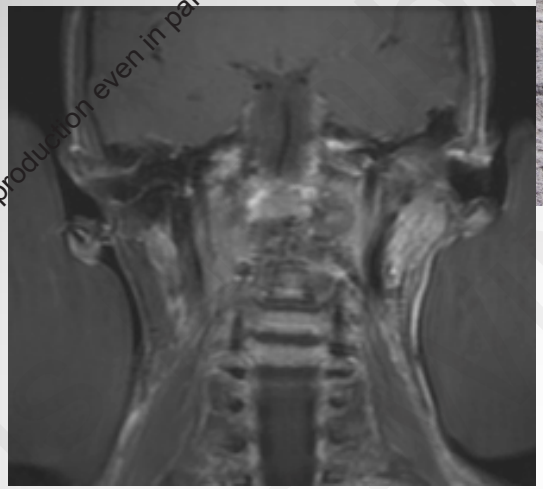


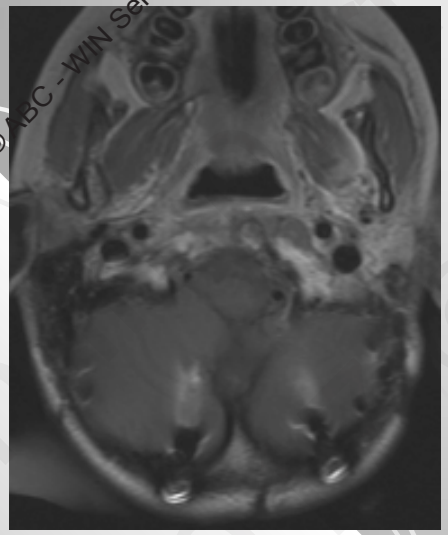
Second surgery from the left side

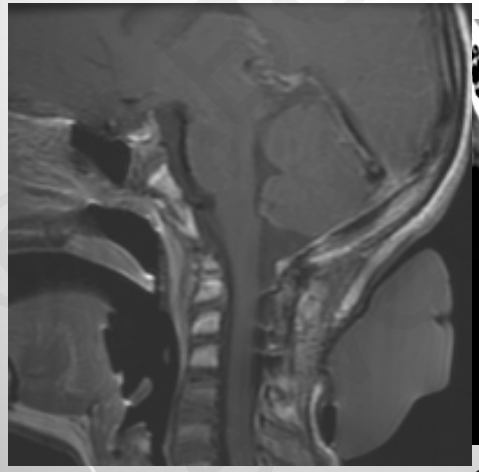


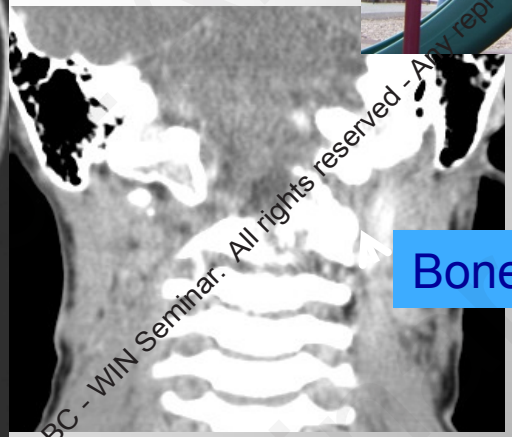
2 and ½ years after treatment











Bone Graft

Small Tumor residue at C 2 Level

No Recurrence after 4 years
Follow Up Karnofsky 100 Sekhar Score: 1

Conclusions

- Vascular Tumors of the Foramen Magnum Area can be safely removed surgically
- Embolization is helpful to reduce bleeding and too reduce the duration of surgery (study in progress)
- A very good understanding of the Anatomy of the region, and of the blood vessels is needed
- A Lateral Approach provides excellent exposure, and allows complete removal with minimal complications in most cases

2017 © ABC - WIN Seminar. All rights reserved. Any reproduction even in part is prohibited.