Neuroan

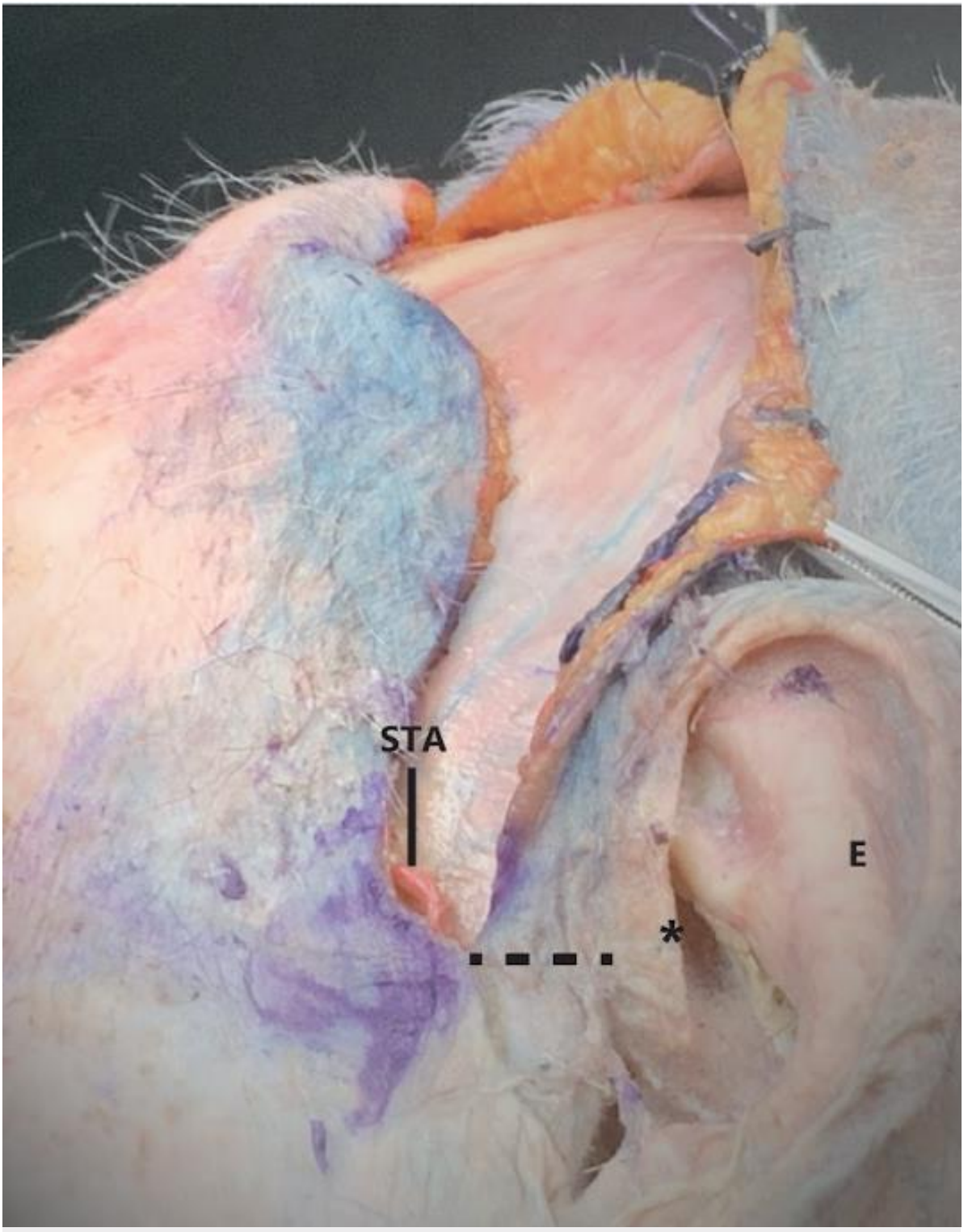
Comprehensive Neuroanatomy and Neurosurgical Atlas

Primarily version

أطلس التشريح العصبي
Neuroan Atlas

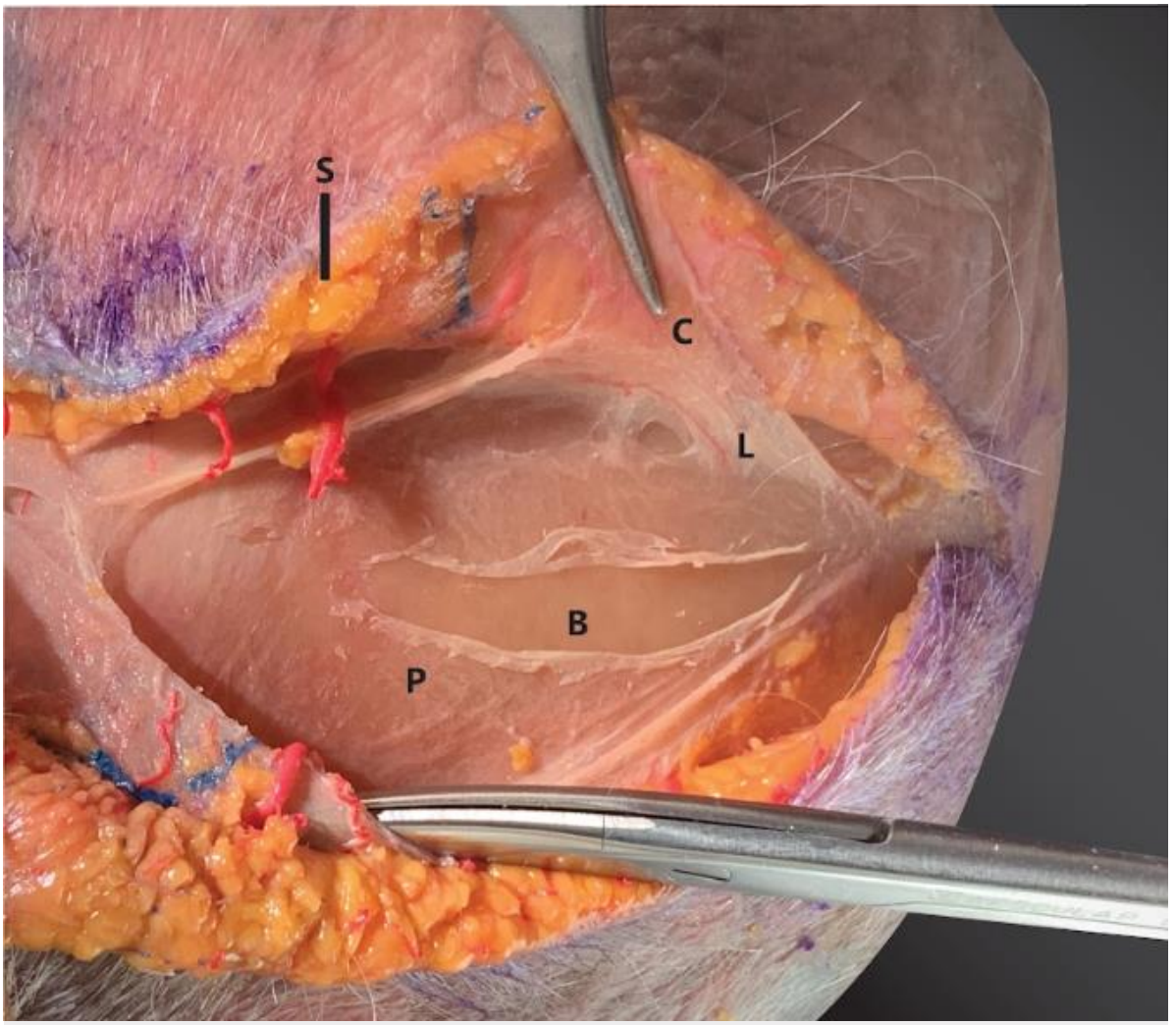
أطلس التشريح العصبي

Neuroan Atlas

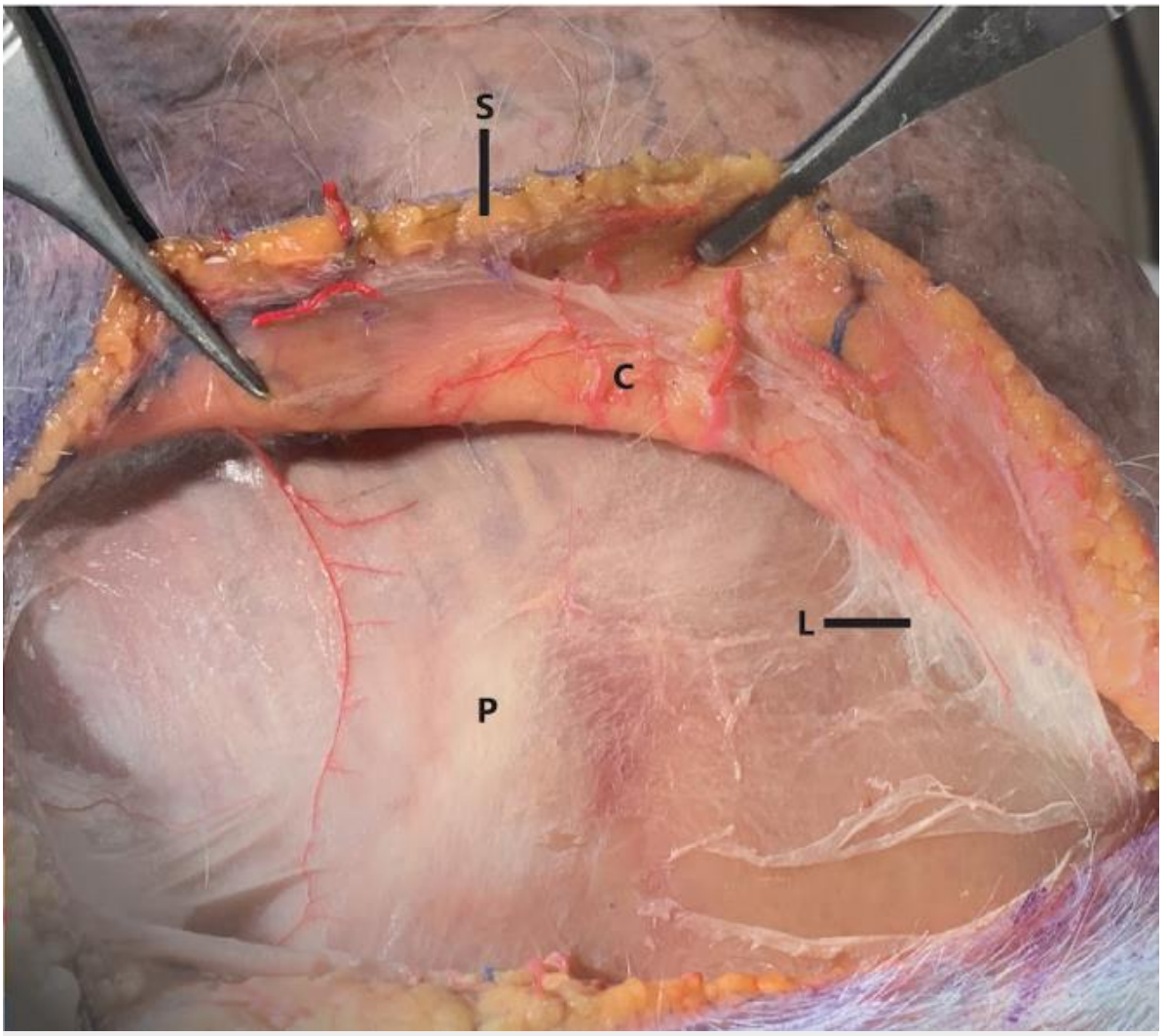


A surgical incision was made approximately one fingerbreadth anterior to the tragus.

STA = superficial temporal artery
Asterisk = tragus
Note the ideal distance between the tragus and STA

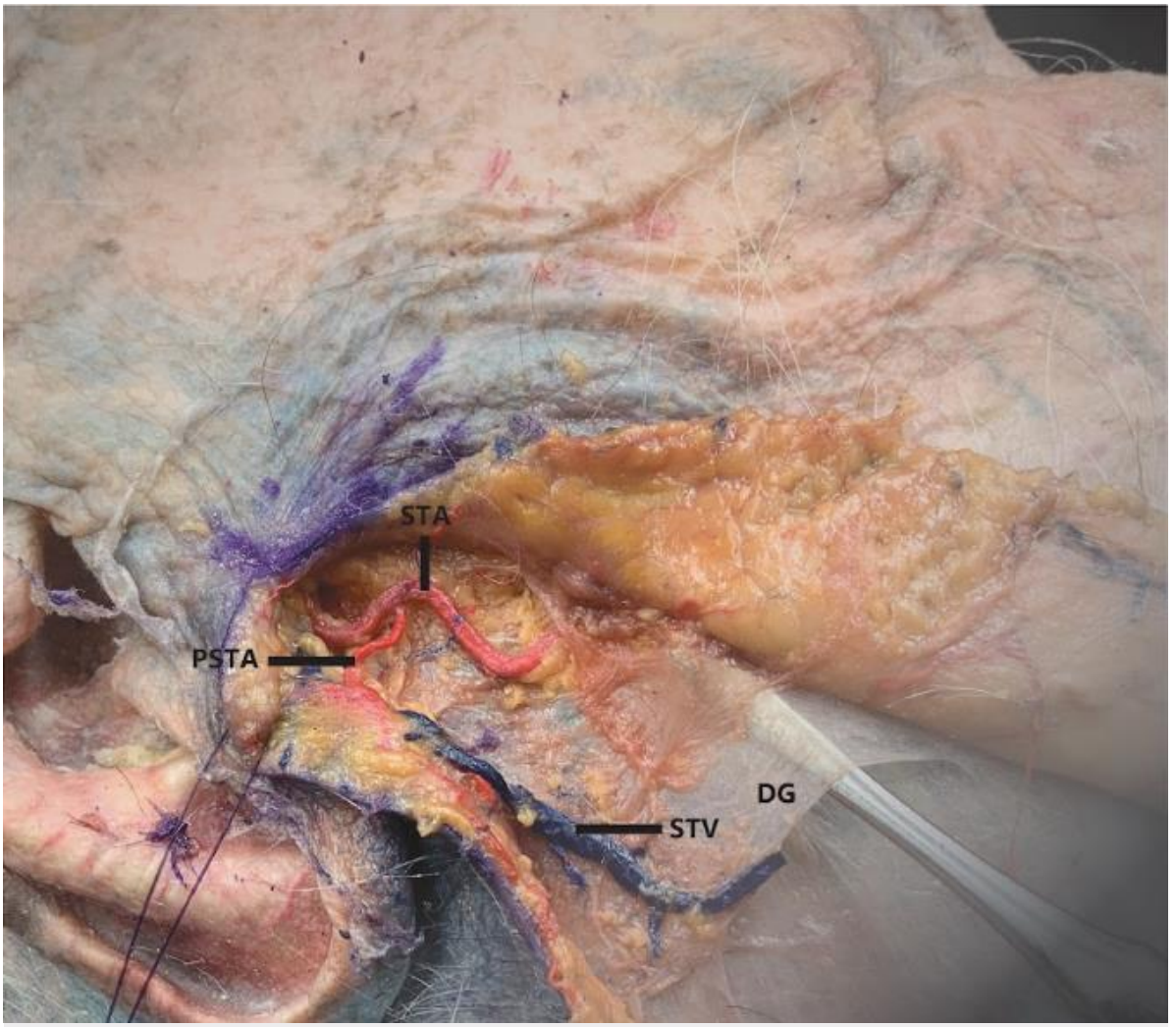


S = skin and subcutaneous fat
C = connective tissue (galea)
L = loose areolar tissue
P = pericranium
B = bone



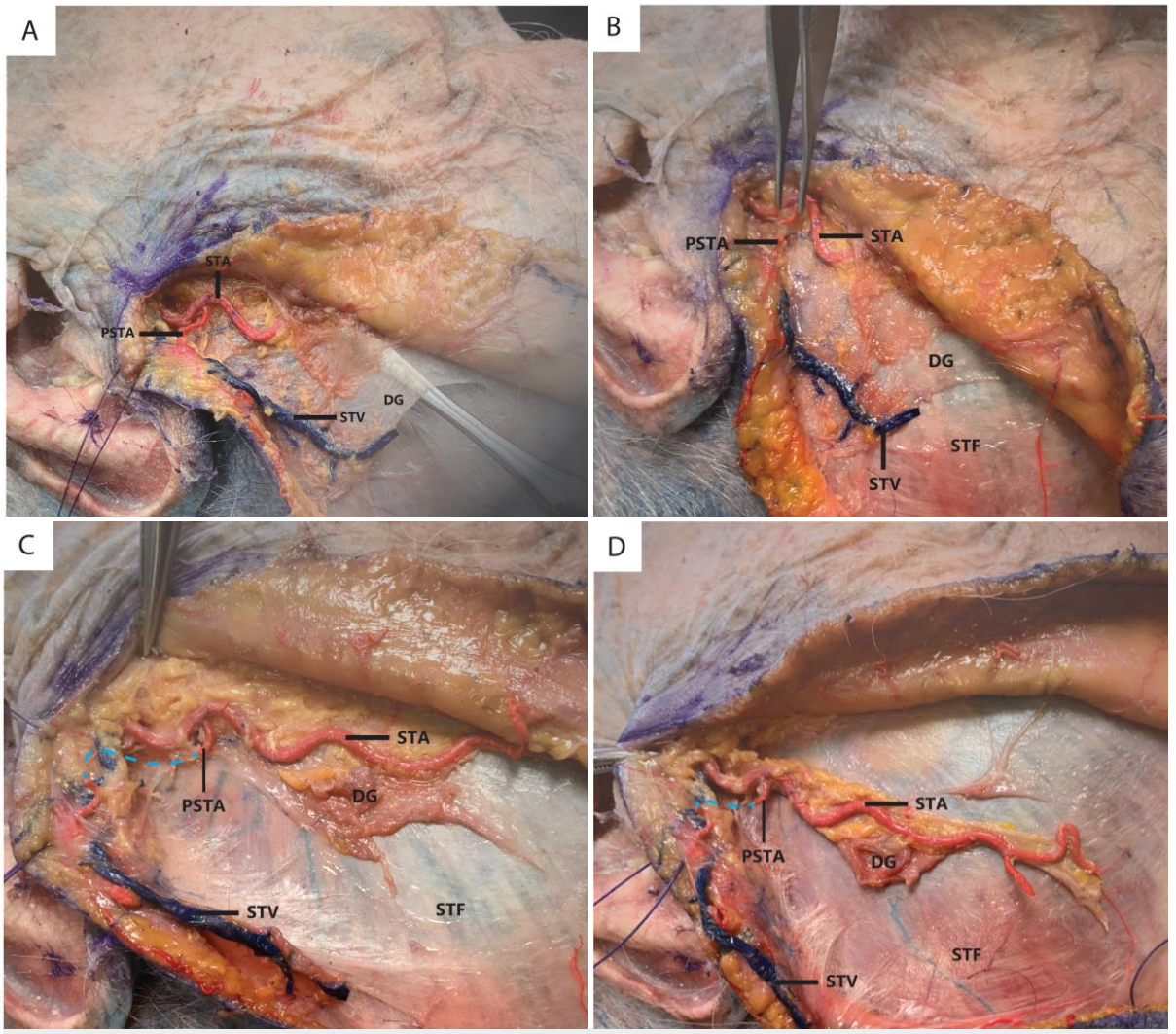
SCALP layers:

S = skin and subcutaneous fat
C = connective tissue (galea)
L = loose areolar tissue
P = pericranium



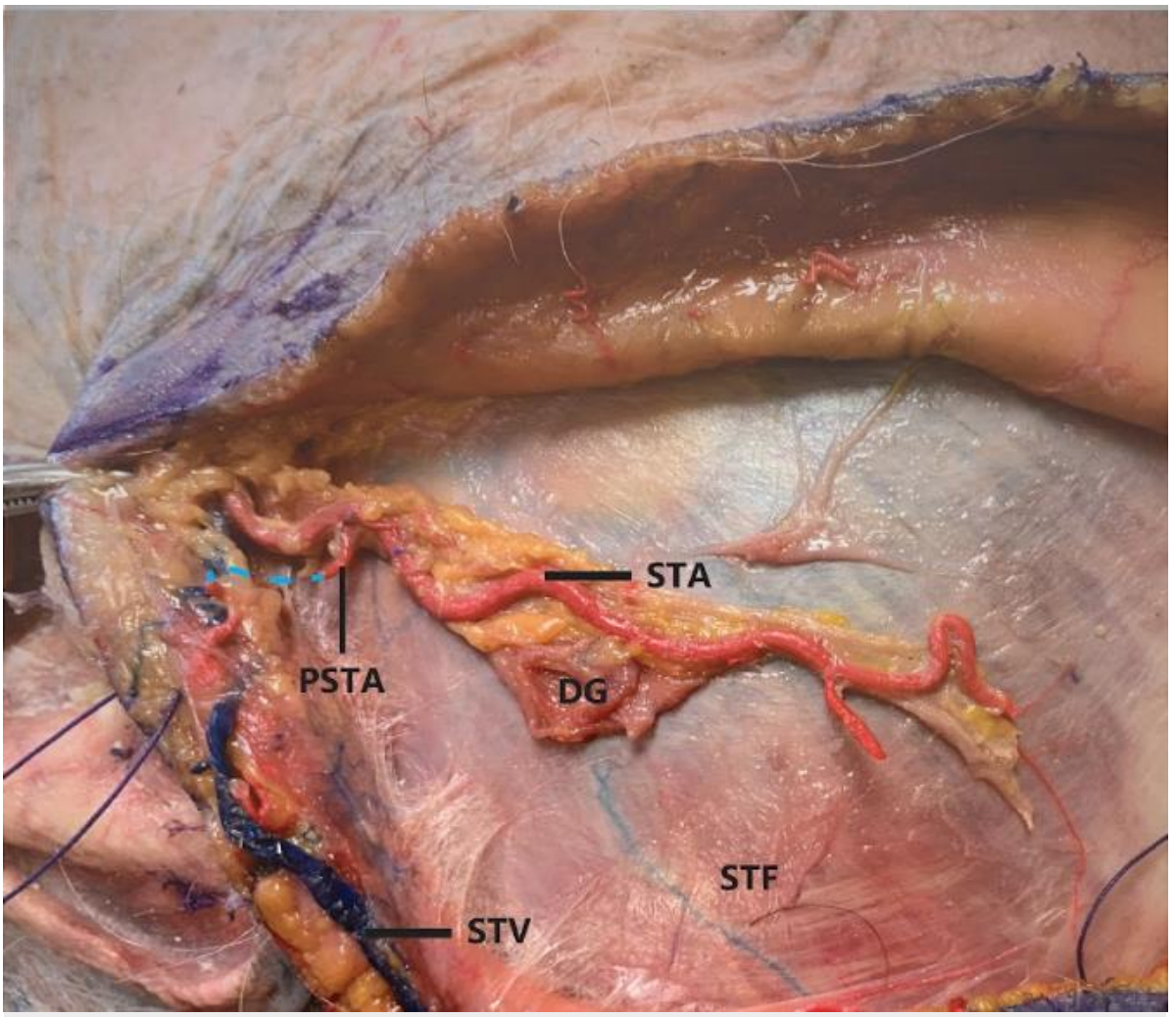
Subcutaneous dissection was made using fine scissor, deep galeal tissue was exposed, which contain the superficial temporal artery (STA).

PSTA = posterior branch of the superficial temporal artery
STV = superficial temporal vein
DG = deep galea



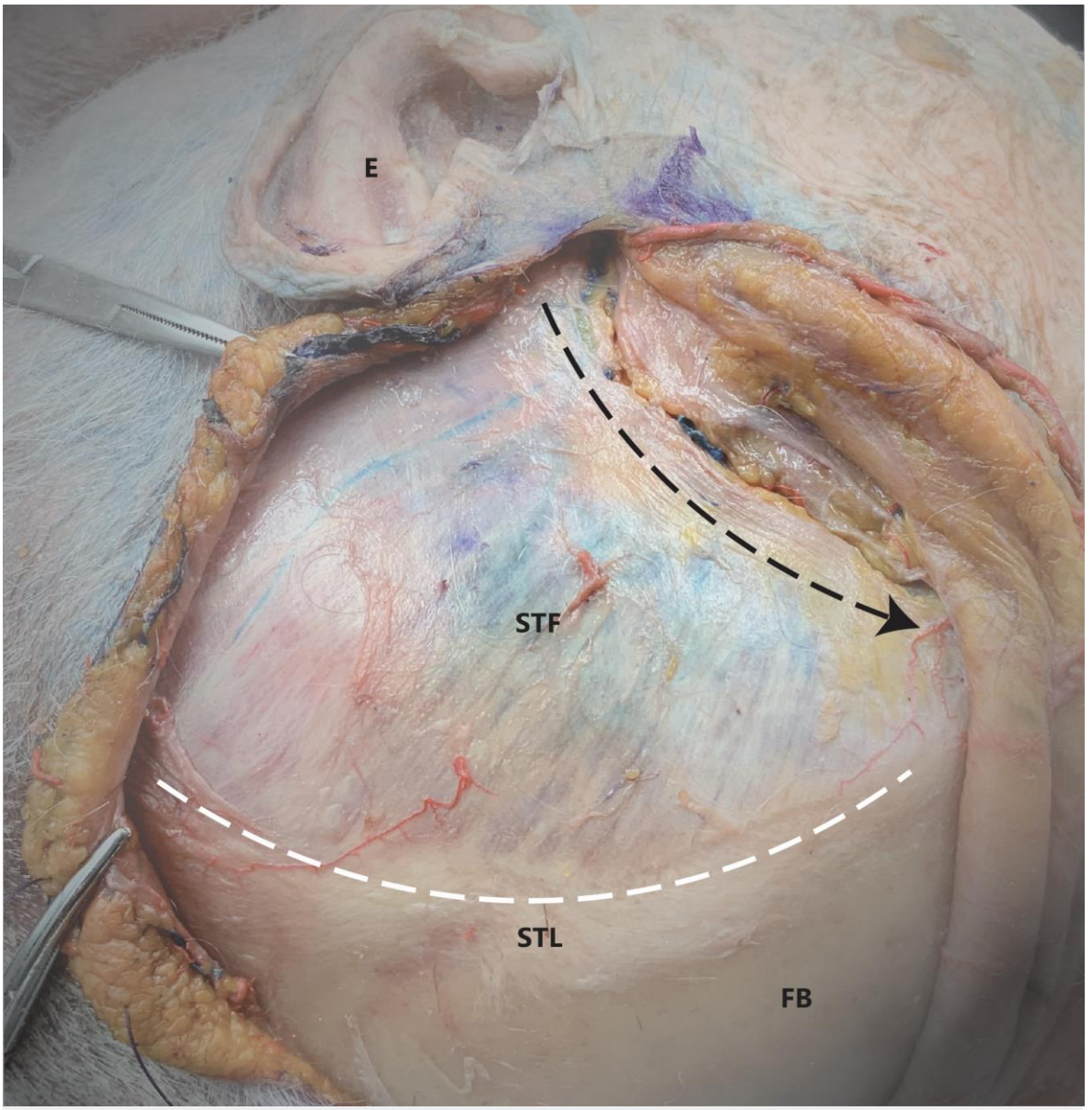
Temporal artery preservation technique. (A) Subcutaneous dissection was made using a fine scissor, and deep galeal tissue was exposed, which contains the superficial temporal artery (STA). (B) A cut was made in the small branch 3 mm away from the STA and (C) the STA was mobilized anteriorly. (D) STA flap with galeal cuff

PSTA = posterior branch of the superficial temporal artery
STV = superficial temporal vein
DG = deep galea
D6 = deep galeal
STF = superficial temporal fascia



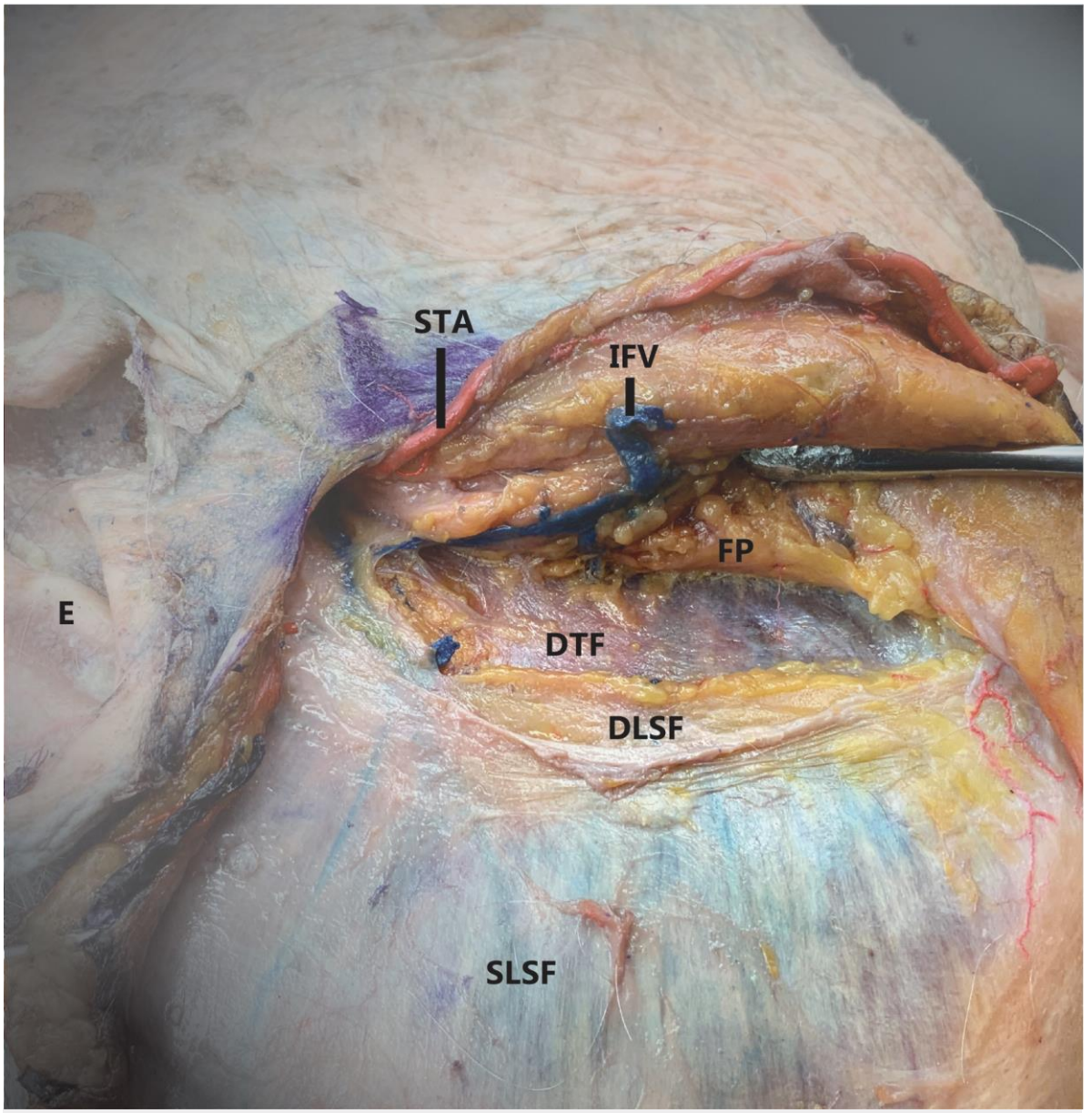
Anterior mobilization of STA was done.

STF = superficial temporal fascia
STA = superficial temporal artery
PSTA = posterior branch of the superficial temporal artery (cutted)
STV = superficial temporal vein
DG = deep galeal layer containing the STA



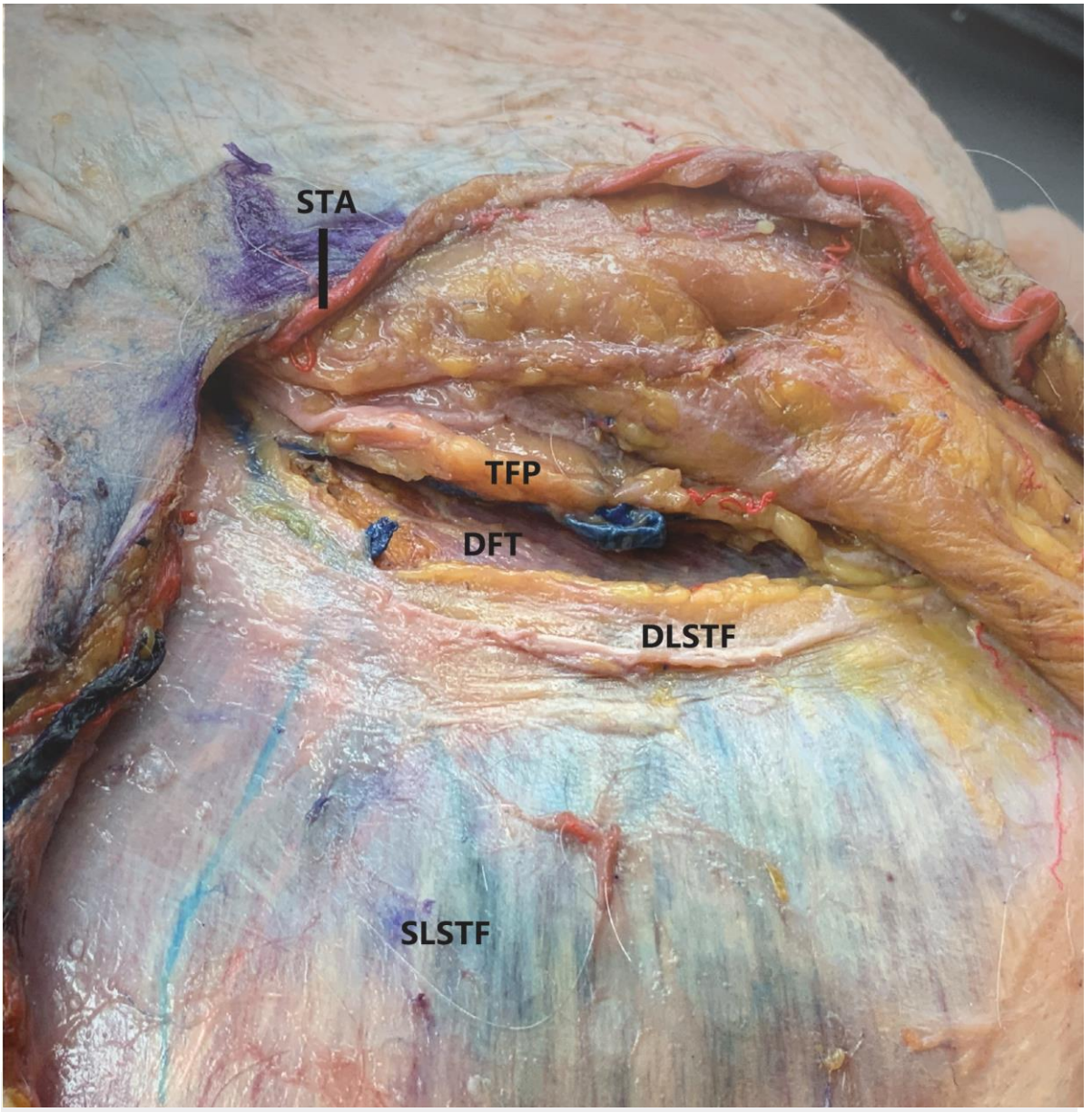
Interfascial dissection. A cut was made, parallel to the posterior root of the zygoma from posterior to anterior.

STF = superficial temporal fascia
E = ear
FB = frontal bone
STL = superior temporal line



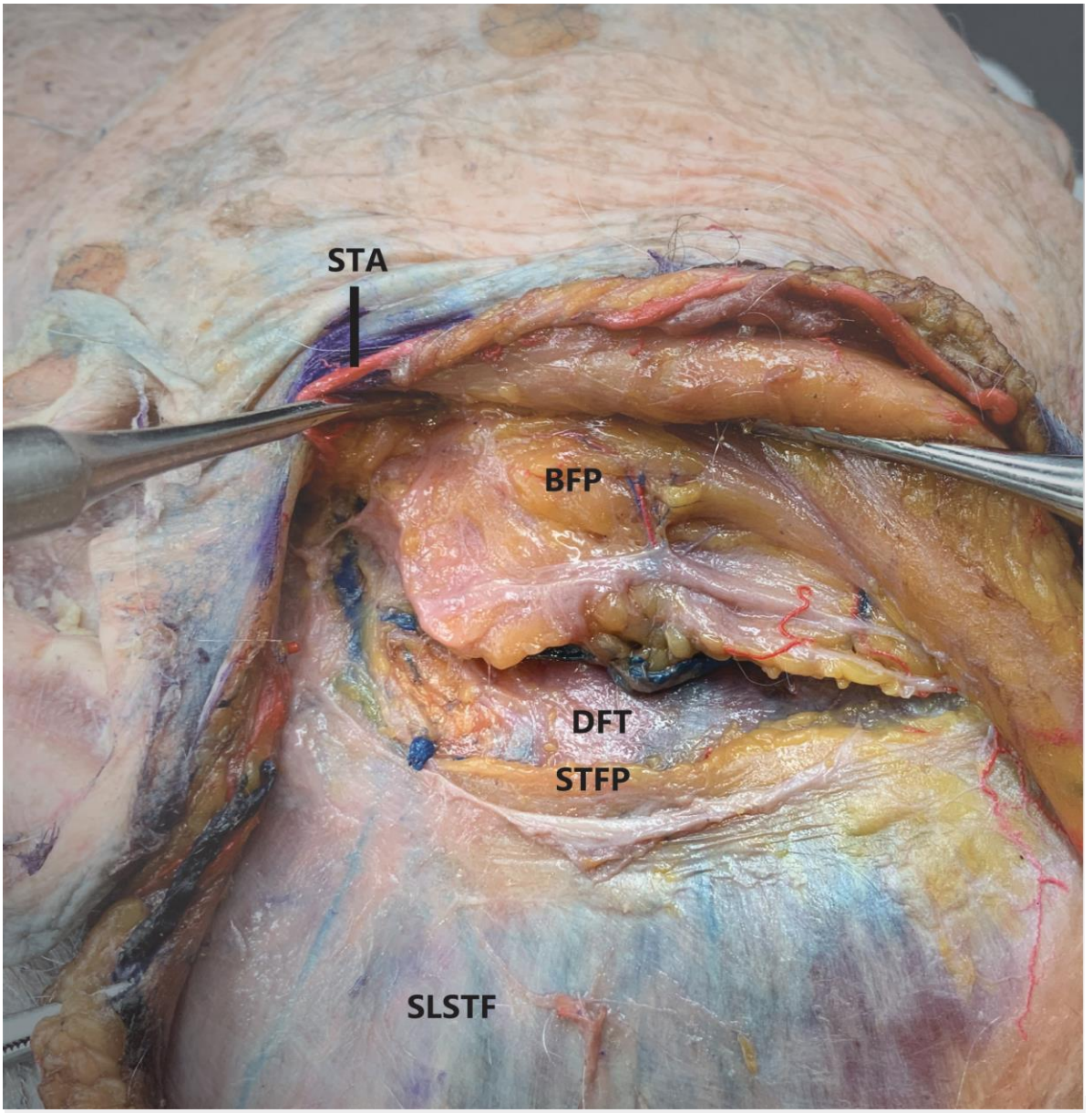
Interfascial dissection. Fat pad (FP) was reflected anteriorly with the flab.

SLSF = superficial layer of superficial temporal fascia
STA = superficial temporal artery
FP = fat pad
DLSF = deep layer of superficial temporal fascia
DTF = deep temporal fascia
IFV = Interfascial vein
E = ear

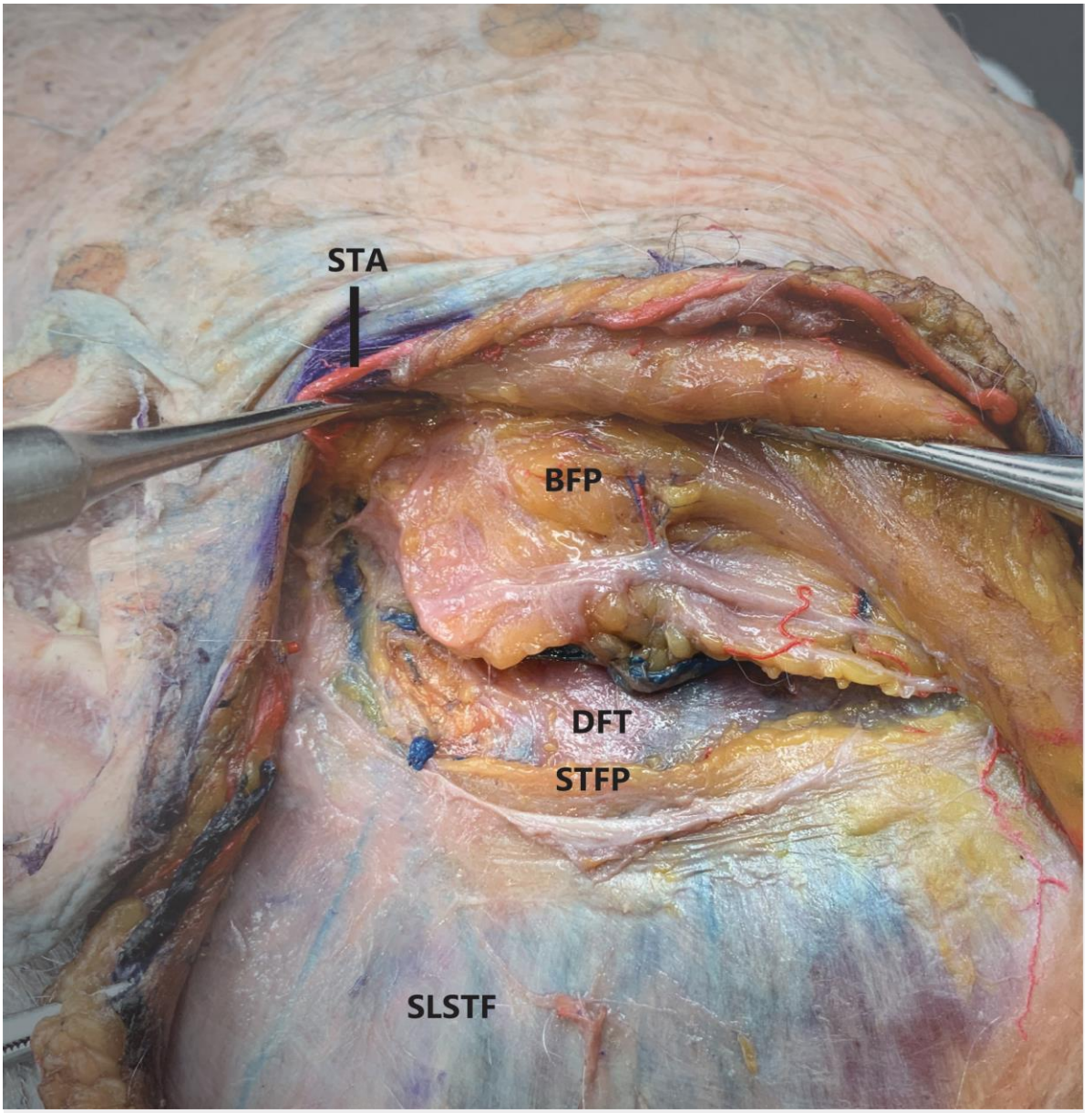


STF = superficial layer of superficial temporal fascia
STA = superficial temporal artery
FP = fat pad

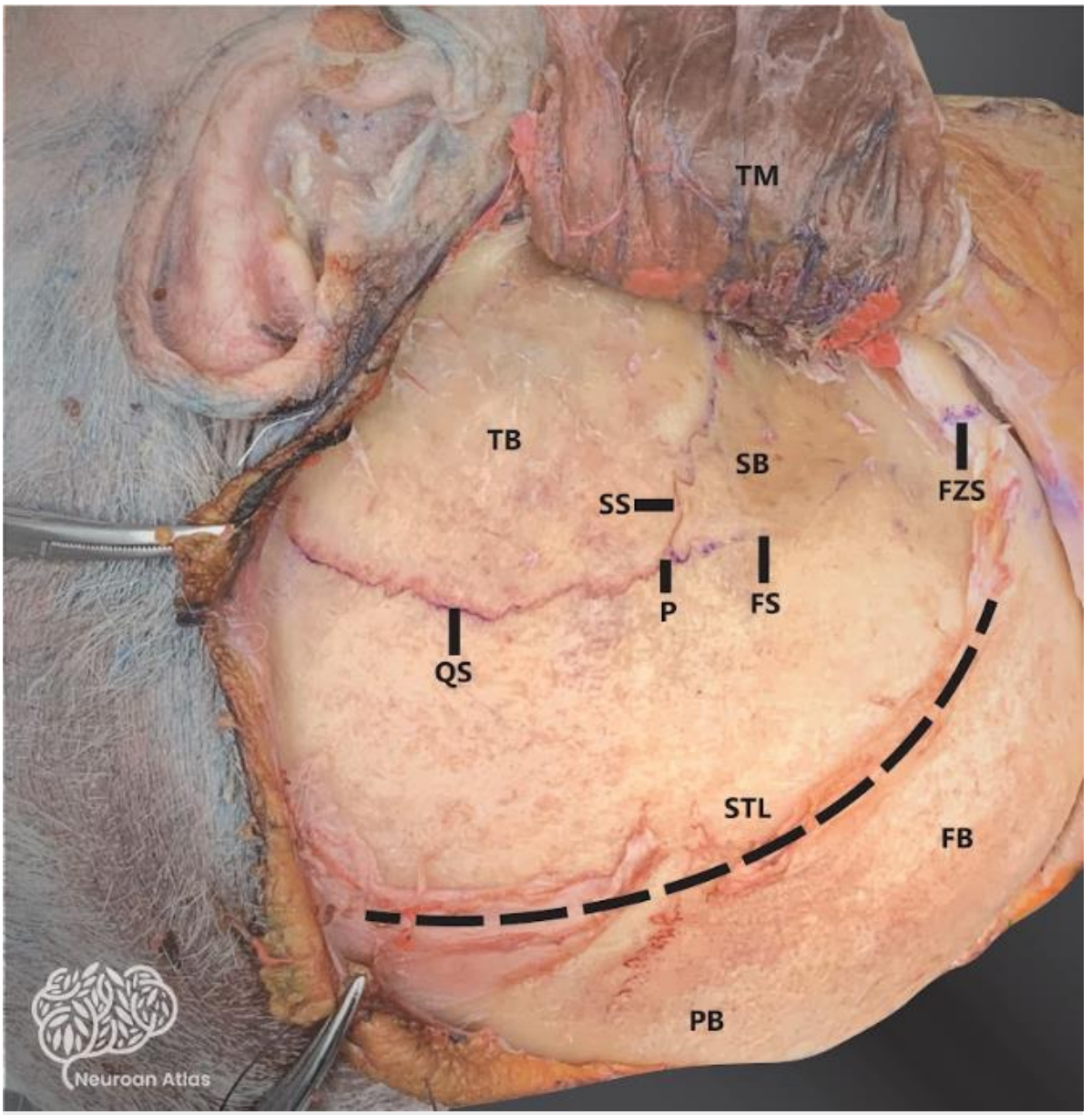
DLSTF = deep layer of superficial temporal fascia
DFT = deep temporal fascia
TFP = temporal fat pad (cutted)



SLSTF = superficial layer of superficial temporal fascia
STA = superficial temporal artery
BFP = buccal fat pad
DFT = deep temporal fascia
STFP = superficial temporal fat pad



SLSTF = superficial layer of superficial temporal fascia
STA = superficial temporal artery
BFP = buccal fat pad
DFT = deep temporal fascia
STFP = superficial temporal fat pad

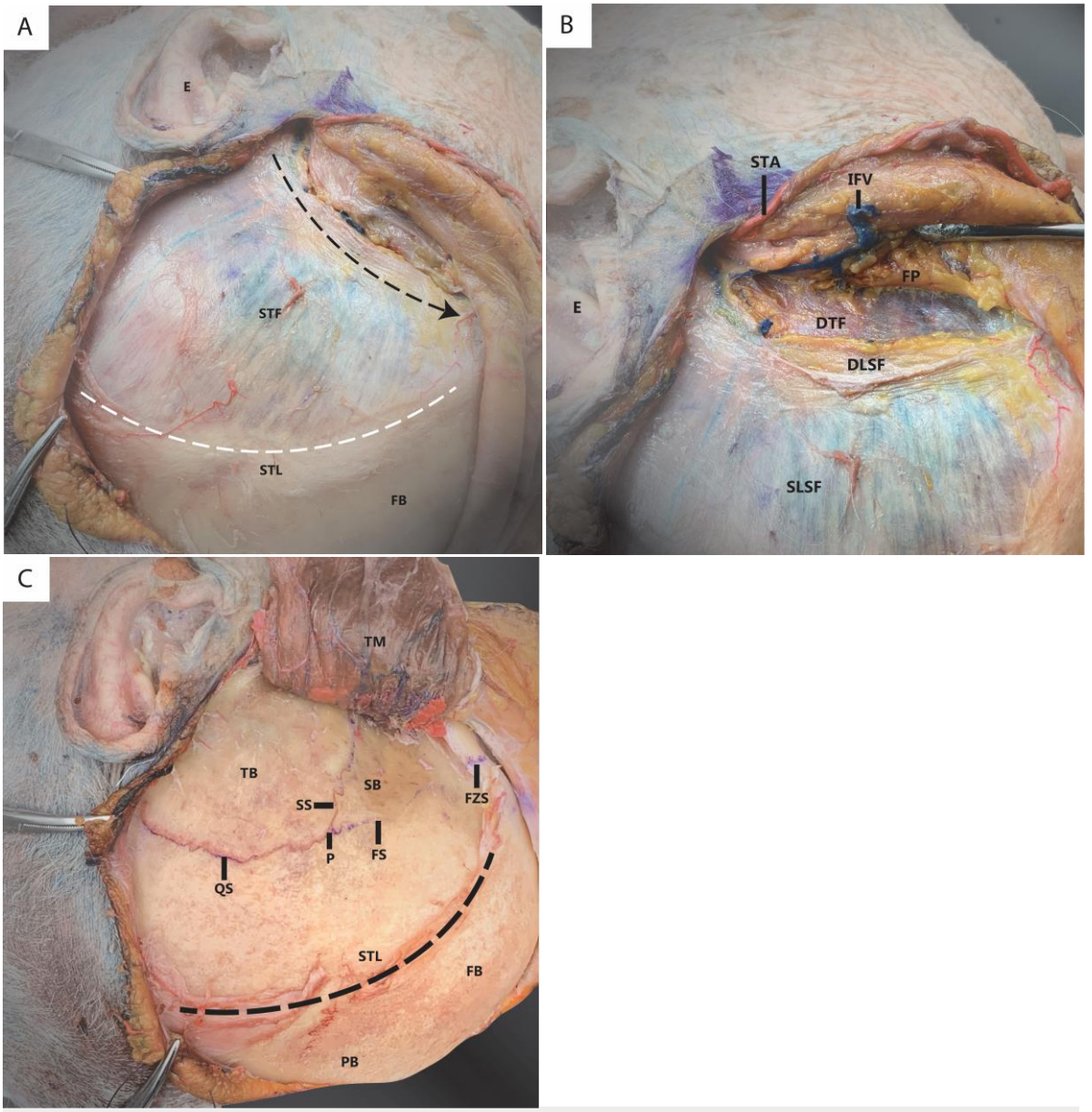


Muscle was released from the superior temporal line (STL) & calf of the fascia was left over STL.

Black dotted line = superior temporal line
FB = frontal bone
PB = parietal bone
SB = sphenoid bone

TB = temporal bone
P = pterion
TM = temporal bone
FS = frontosphenoid suture

QS = squamous suture
SS = sphenosquamosal bone



(A) Interfascial dissection. A cut was made, parallel to the posterior root of the zygoma directed posterior to anterior.

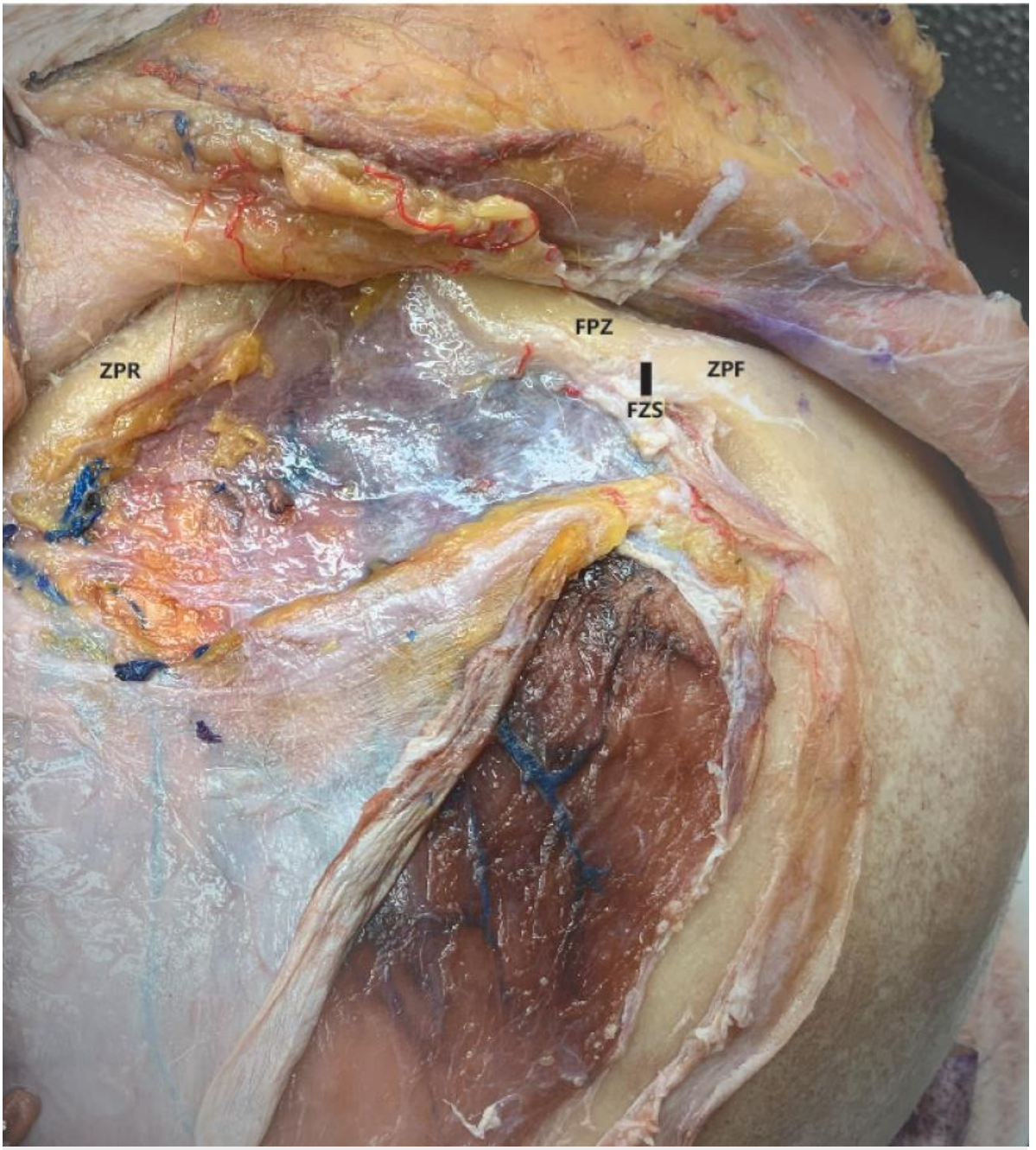
(B) Interfascial dissection. Fat pad (FP) was reflected anteriorly with the flab. SLSF = superficial layer of superficial temporal fascia.

(C) Muscle was released from STL & calf of the fascia was left over STL.

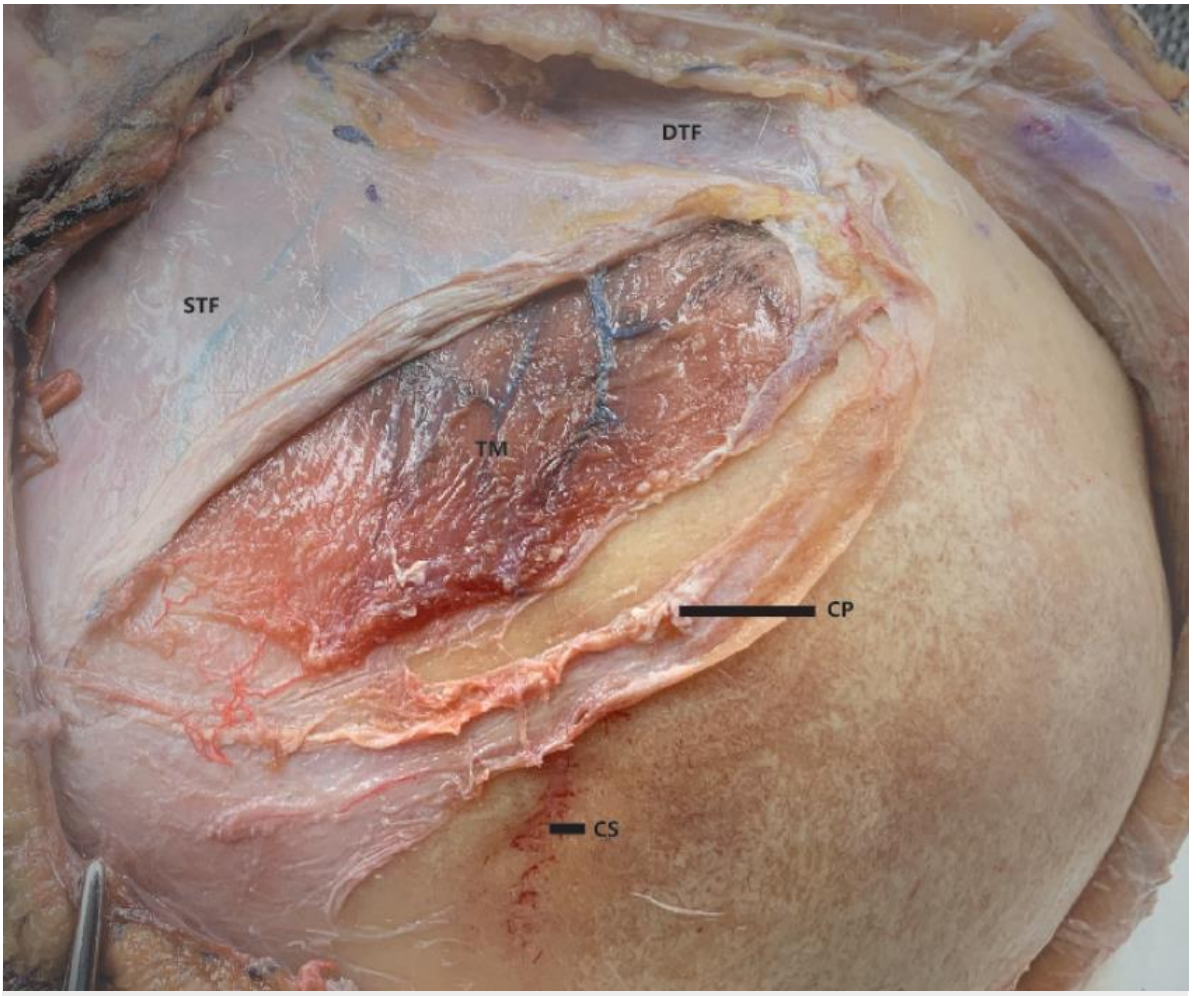
STF = superficial temporal fascia
STA = superficial temporal artery
FP = fat pad
DLSF = deep layer of superficial temporal fascia
DTF = deep temporal fascia

TM = temporal bone
FS = frontosphenoid suture
QS = squamous suture
SS = sphenosquamous suture
FZS = fronto-zygomatic suture
TM = temporalis muscle
TB = temporal bone
P = pterion

IFV = Interfascial vein
PB = parietal bone
SB = sphenoid bone

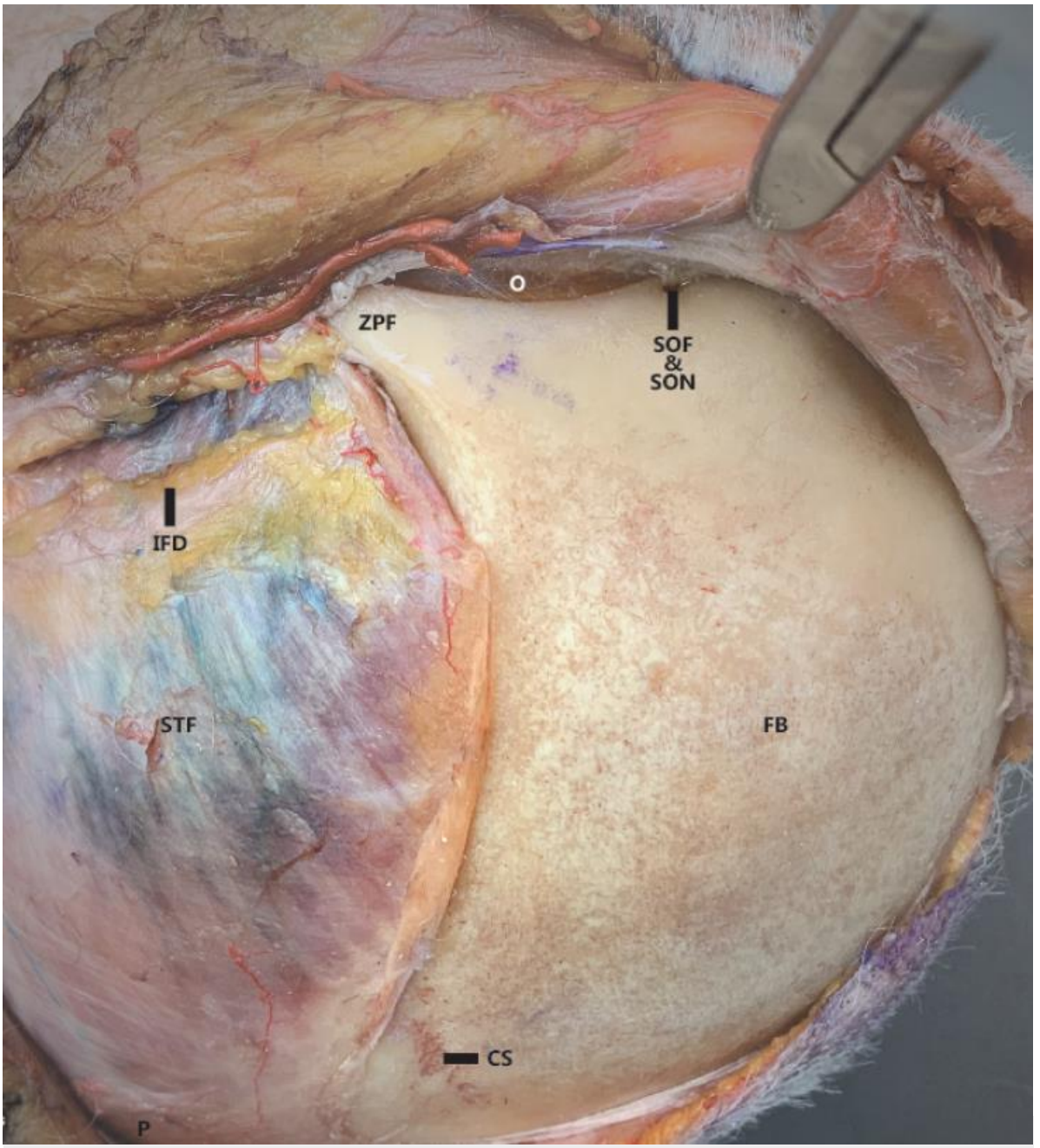


ZPF = zygomatic process of the frontal bone
FPZ = frontal process of the zygomatic bone
FZS = frontozygomatic suture
ZPR = zygomatic posterior root



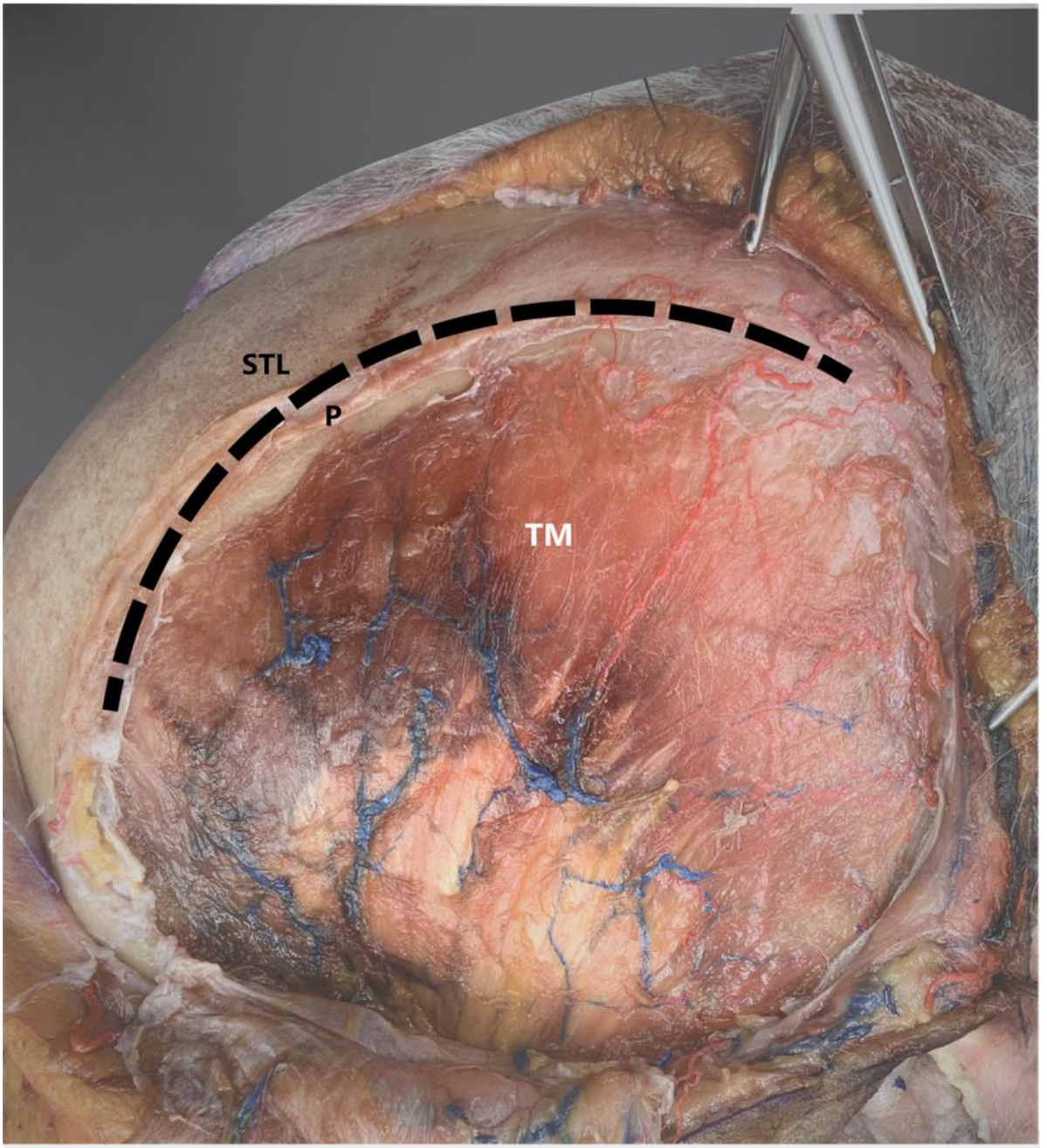
Demonstration of the facial layer in relation to temporalis muscle.

STF = superficial temporal fascia
DTF = deep temporal fascia
CP = cuff of pericranium



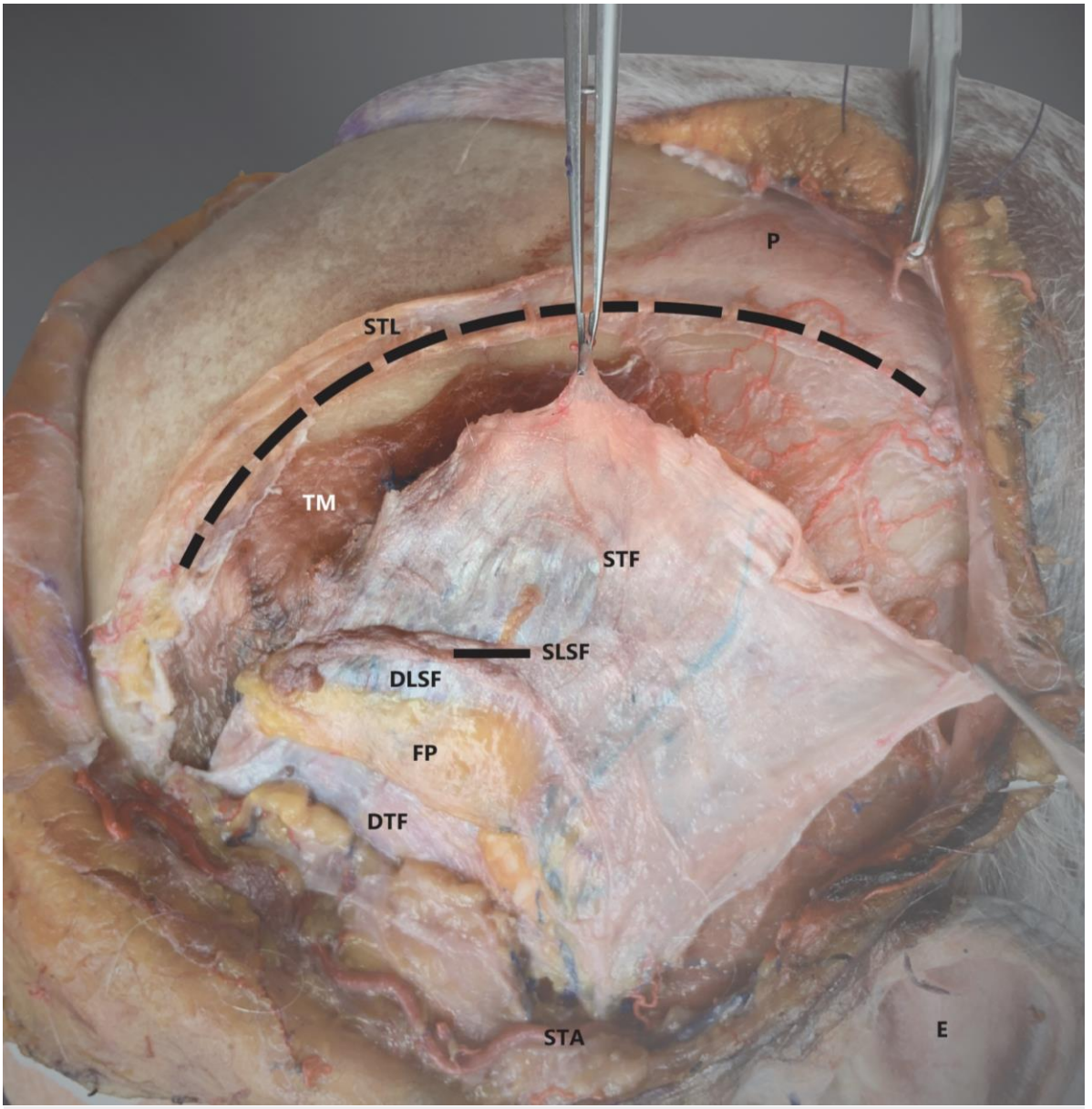
P = pericranium
5TF = superficial temporal fascia;

C5 = coronal suture
ZPF = zygomatic process of frontal bone
SOF = supraorbital foramina
SON = supraorbital nerve
O = orbit.
FB = frontal bone
IFD = interfascial dissection;



Superficial temporal fascia and deep temporal fascia were removed in this specimen for anatomical illustration.

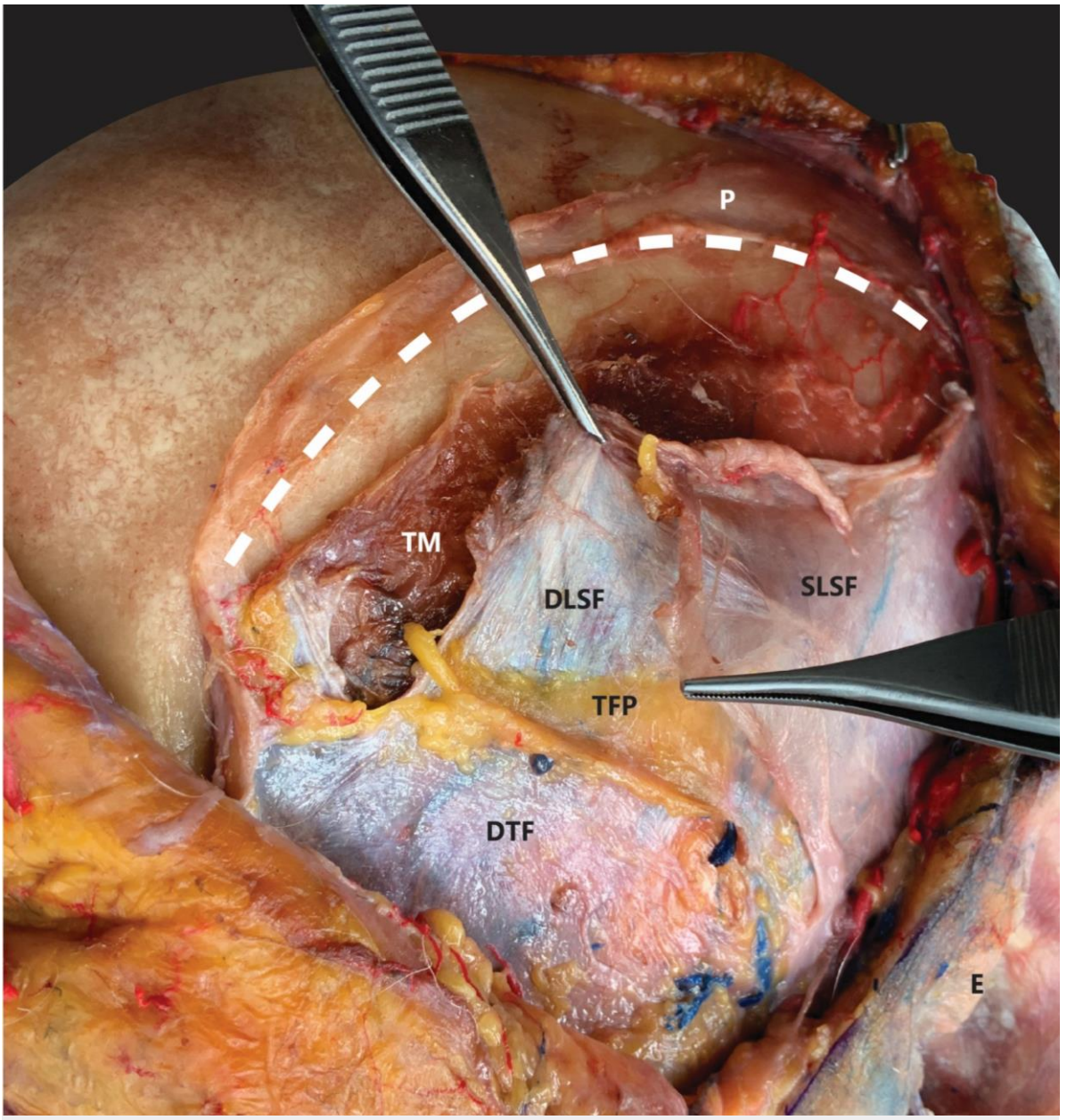
TM = temporalis muscle
STL = superior temporal line
P = cuff of pericranium



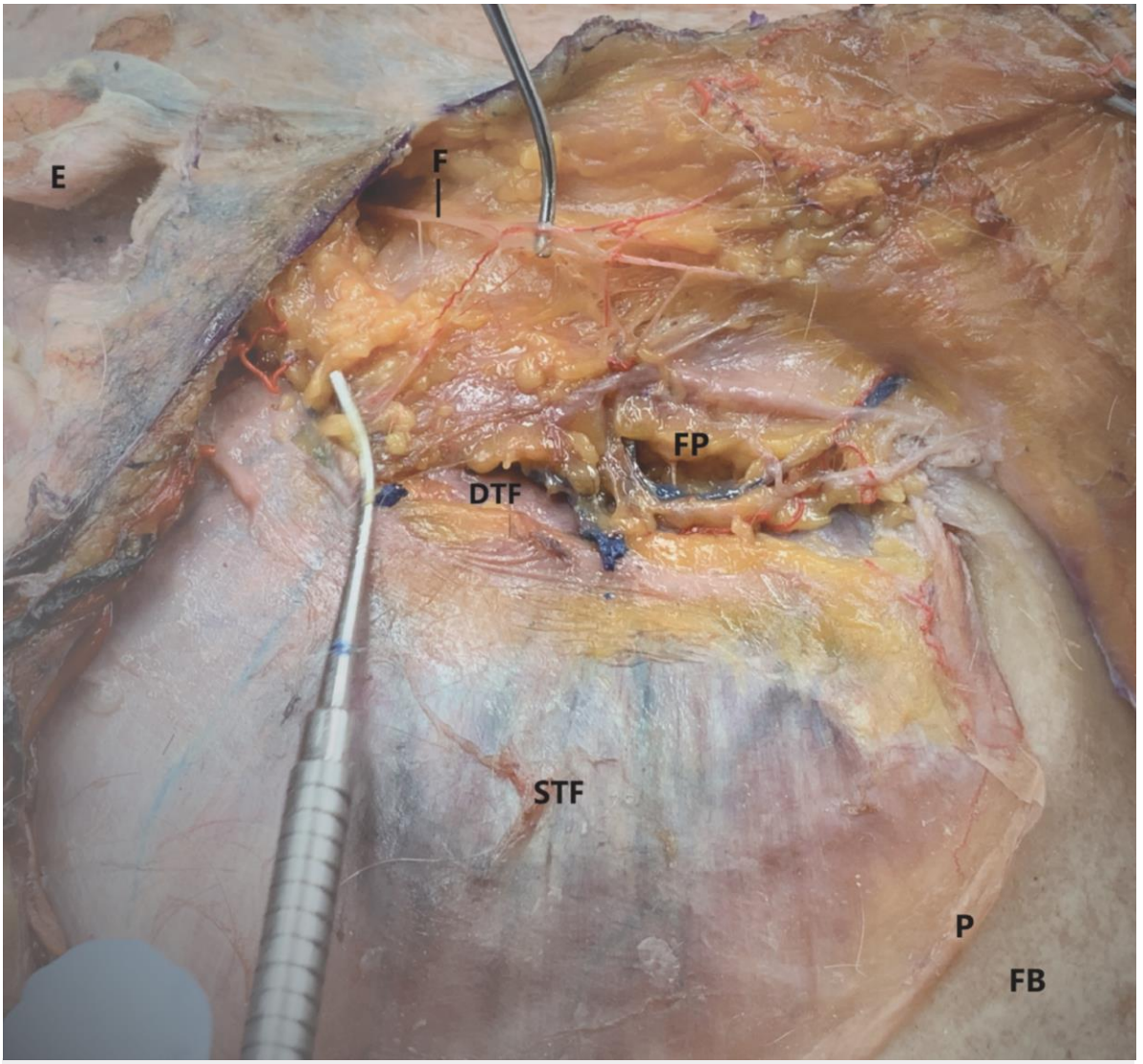
STL = superior temporal line
STA = superficial temporal artery
FP = fat pad
P = peri cranium

STF = superficial temporal fascia
DLSF = deep layer of superficial temporal fascia
DTF = deep temporal fascia

SLSF = superficial layer of superficial temporal fascia
TM = temporalis muscle
E = ear

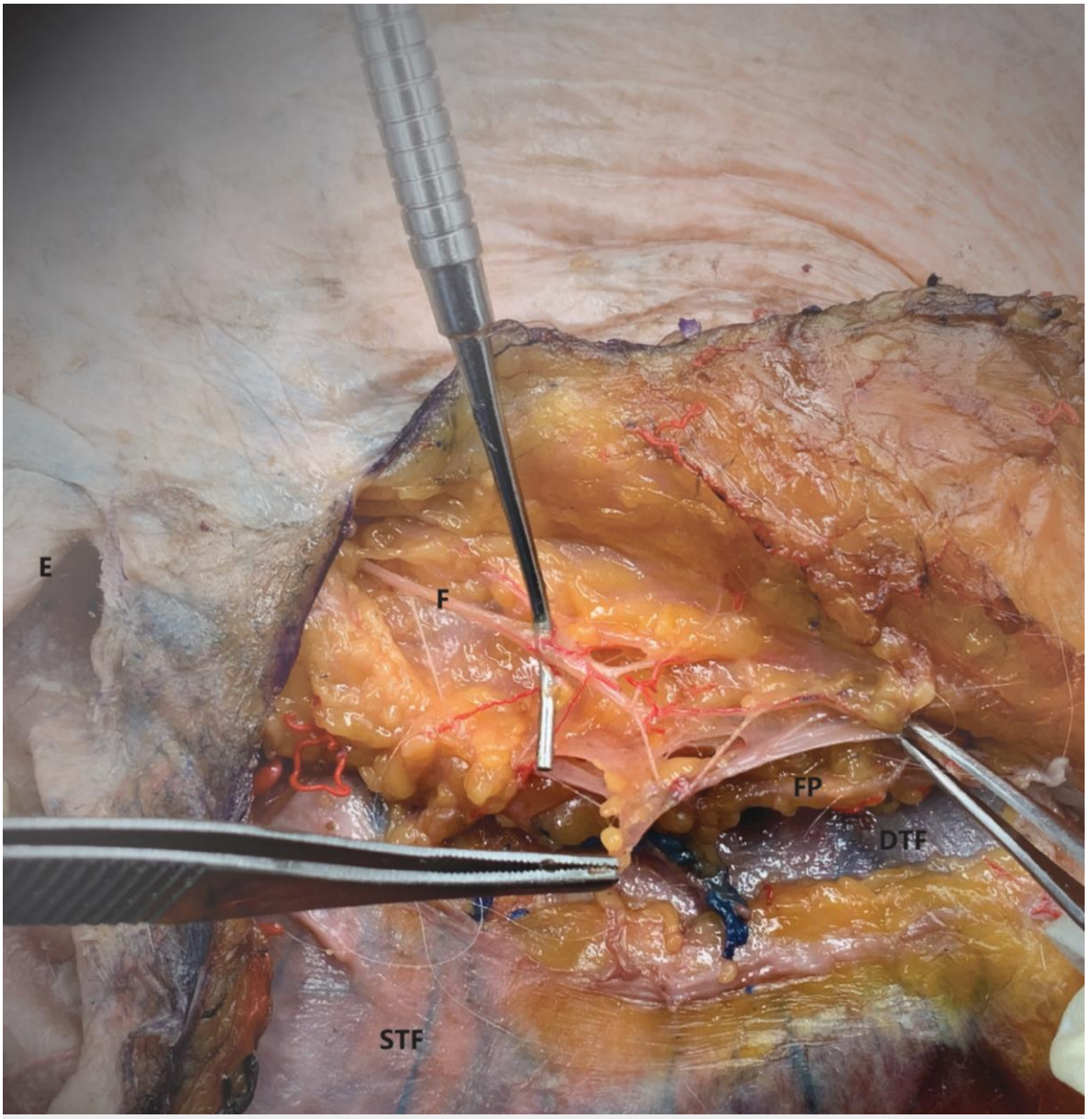


P = pericranium
SLSF = superficial layer of superficial temporal fascia
DLSF = deep layer of superficial temporal fascia
DFT = deep temporal fascia
TFP = temporal fat pad
TM = temporalis muscle
E = ear



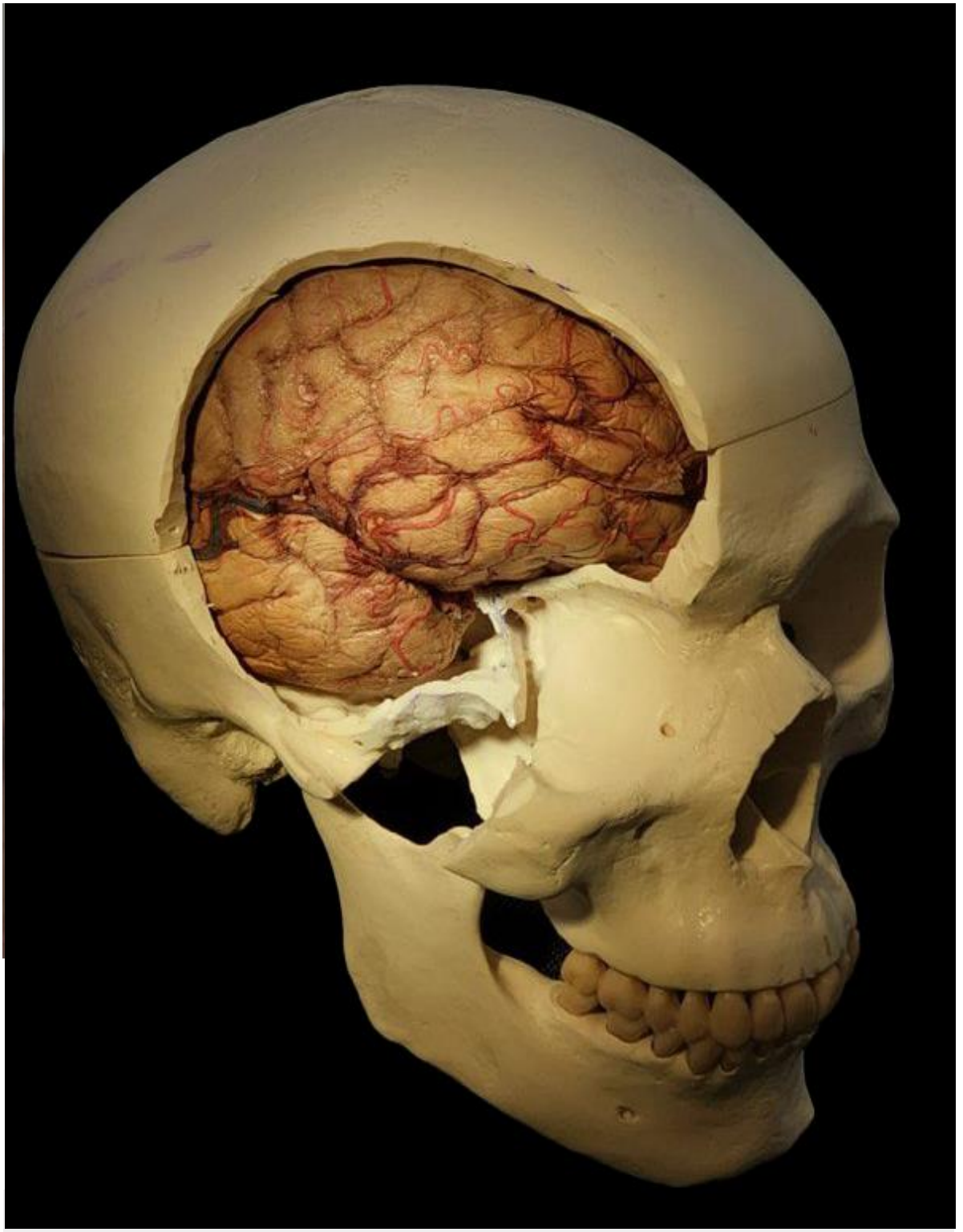
A branch of the facial nerve goes through the interfascial fat pad.

F = branch of the facial nerve
STF = superficial temporal fascia
DFT = deep temporal fascia
FB = frontal bone
FP = fat pad
E = ear

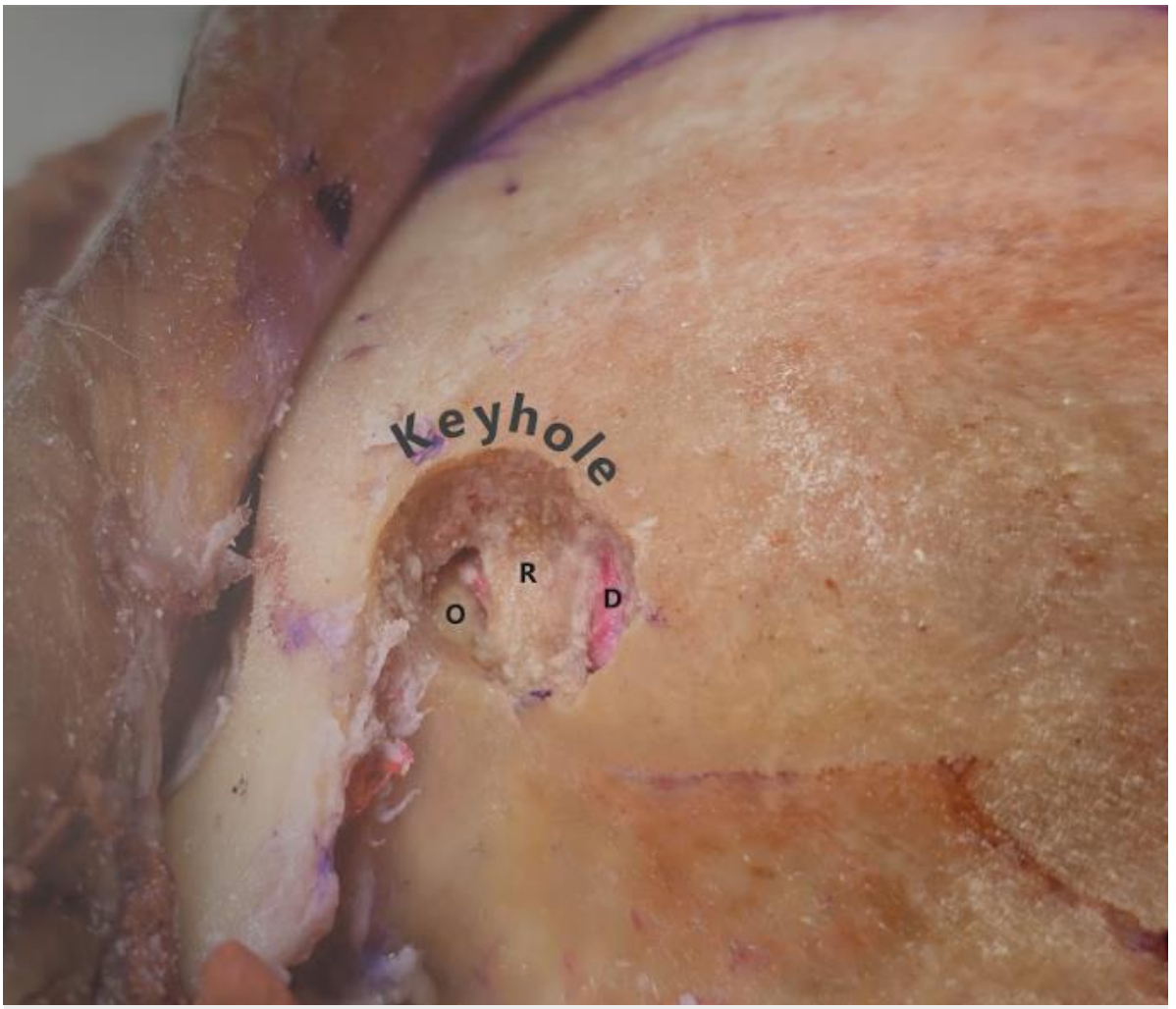


Frontotemporal branch of the facial nerve as it passes through the superficial temporal fat pad.

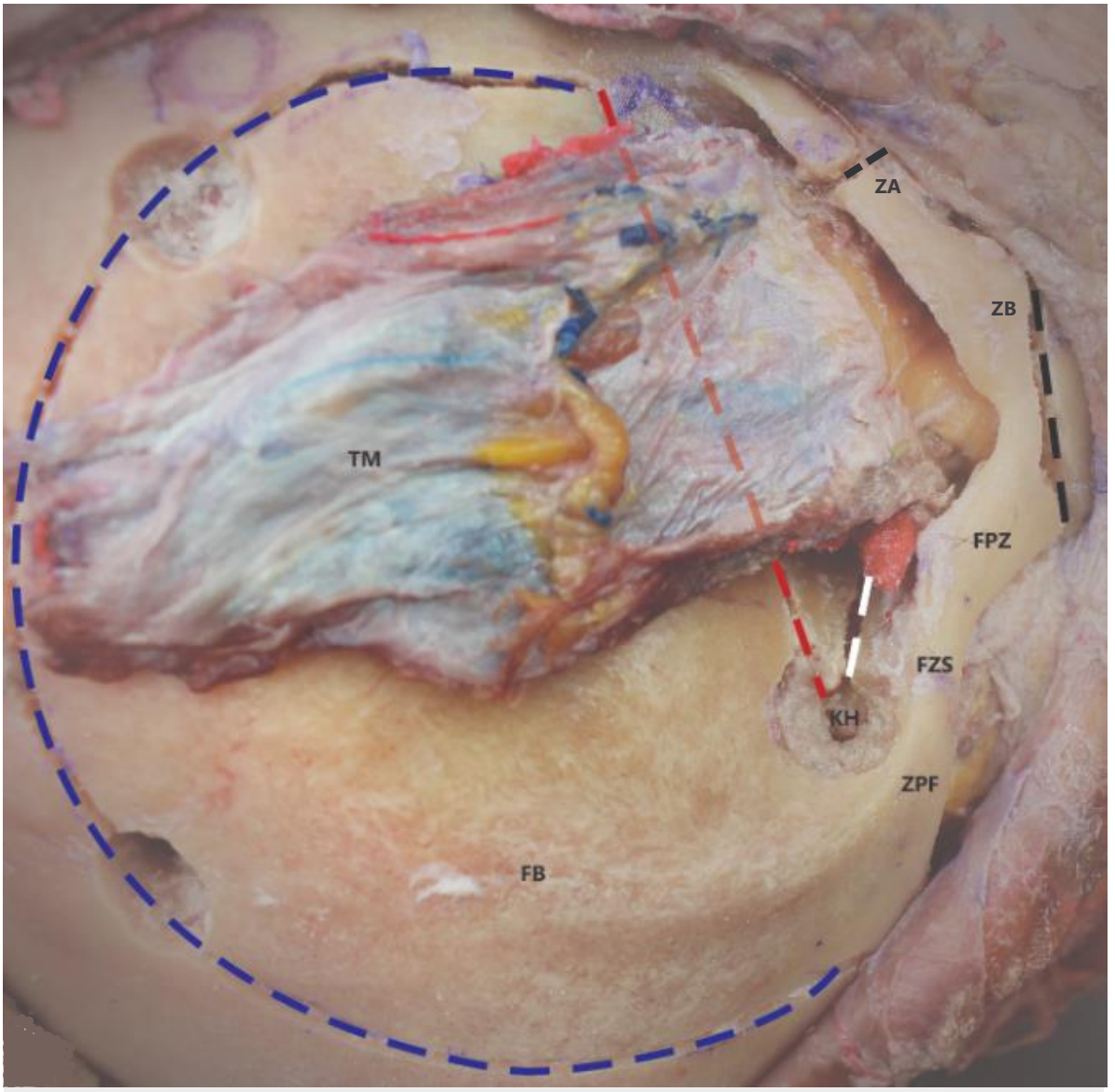
F = frontotemporal branch of the facial nerve
STF = superficial temporal fascia
DFT = deep temporal fascia
FP = fat pad
E = ear



Orbitozygomatic craniotomy exposure

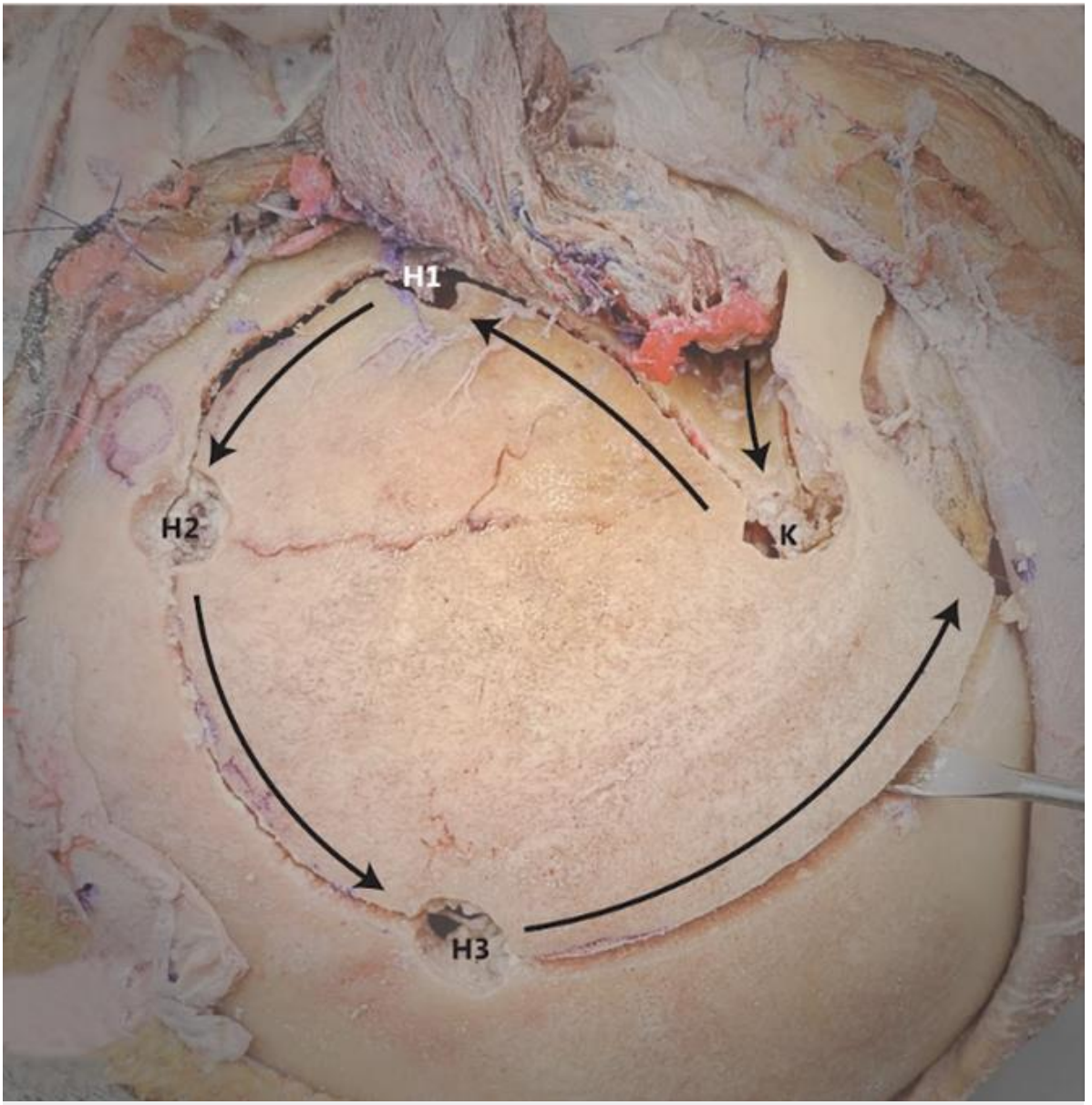


R = roof of orbit
O = orbitia
D = frontal dura

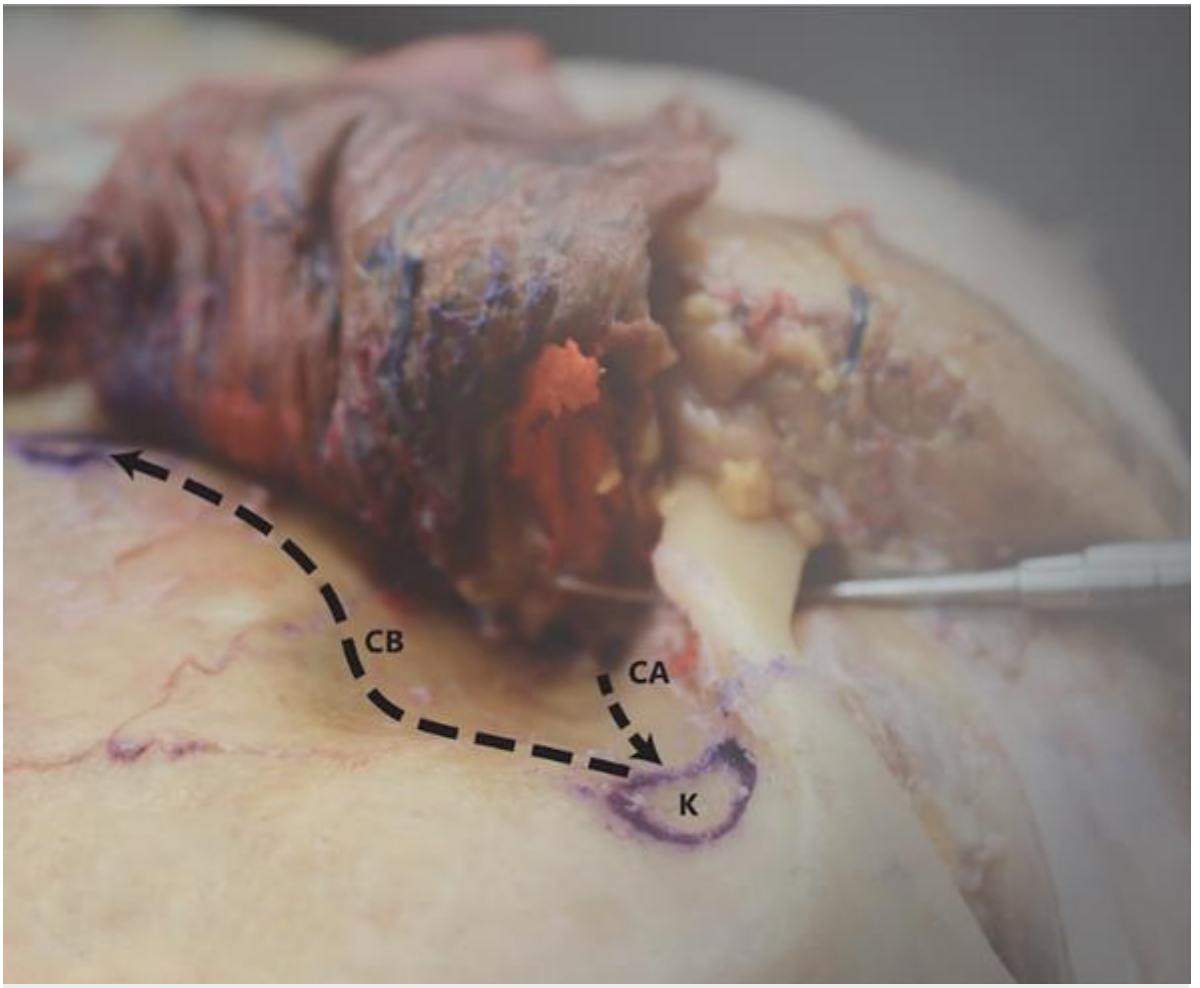


The orbitozygomatic craniotomy cut.

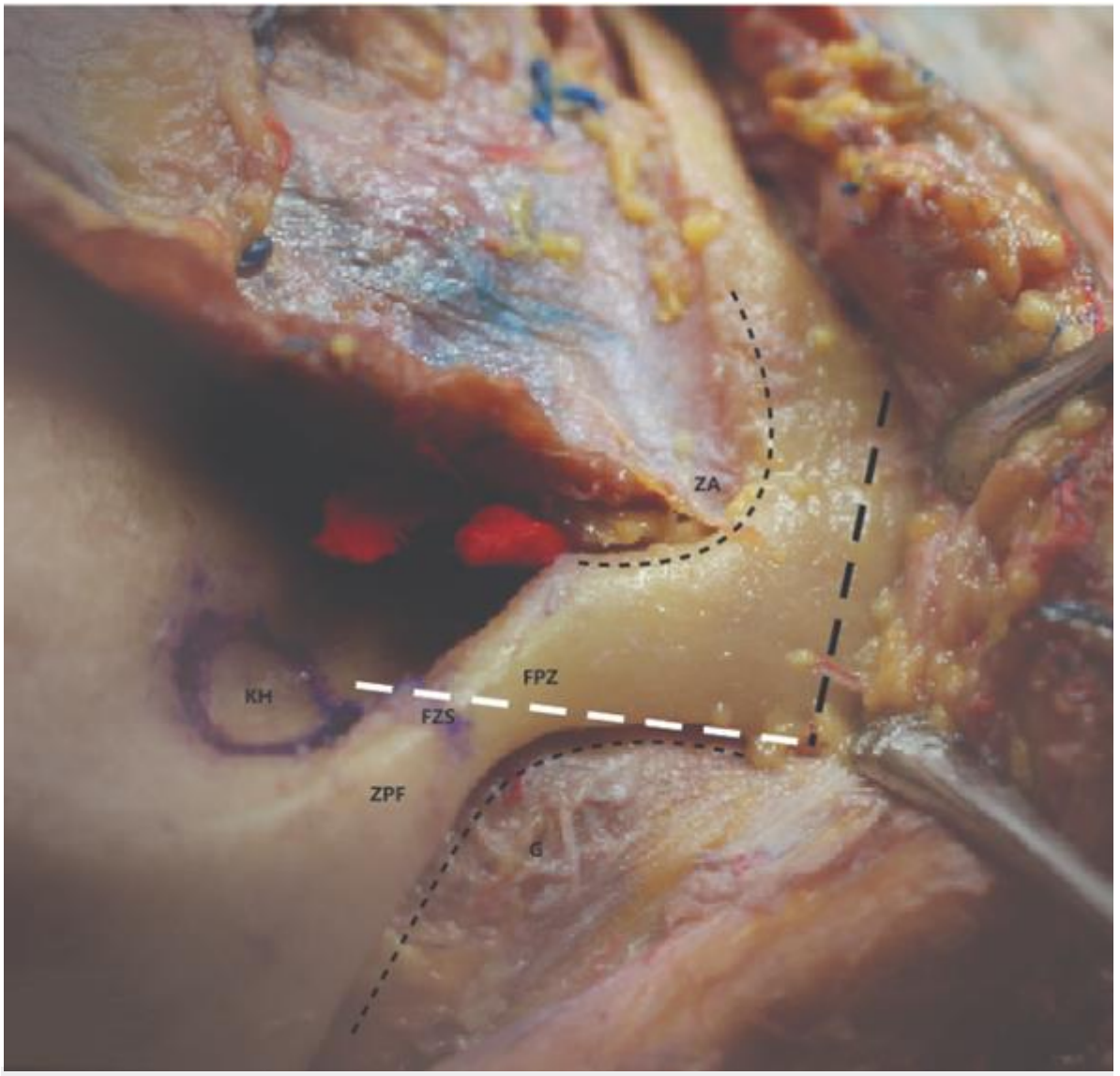
ZPF = zygomatic process of the frontal bone
FPZ = frontal process of the zygomatic bone
FZS = frontozygomatic suture
FB = frontal bone
KH = keyhole
TM = temporalis bone
ZA = zygomatic arch
ZB=zygomatic bone



K = MacCarty keyhole
H1 = first burr hole located above the posterior root of the zygomatic bone
H2 = second burr hole on the temporal bone over the squamous suture
H3= third burr hole position anterior to the coronal suture



K = MacCarty keyhole
CA = cut A from the inferior orbital fissure to MacCarty keyhole
CB = cut B from MacCarty keyhole to the next burr hole

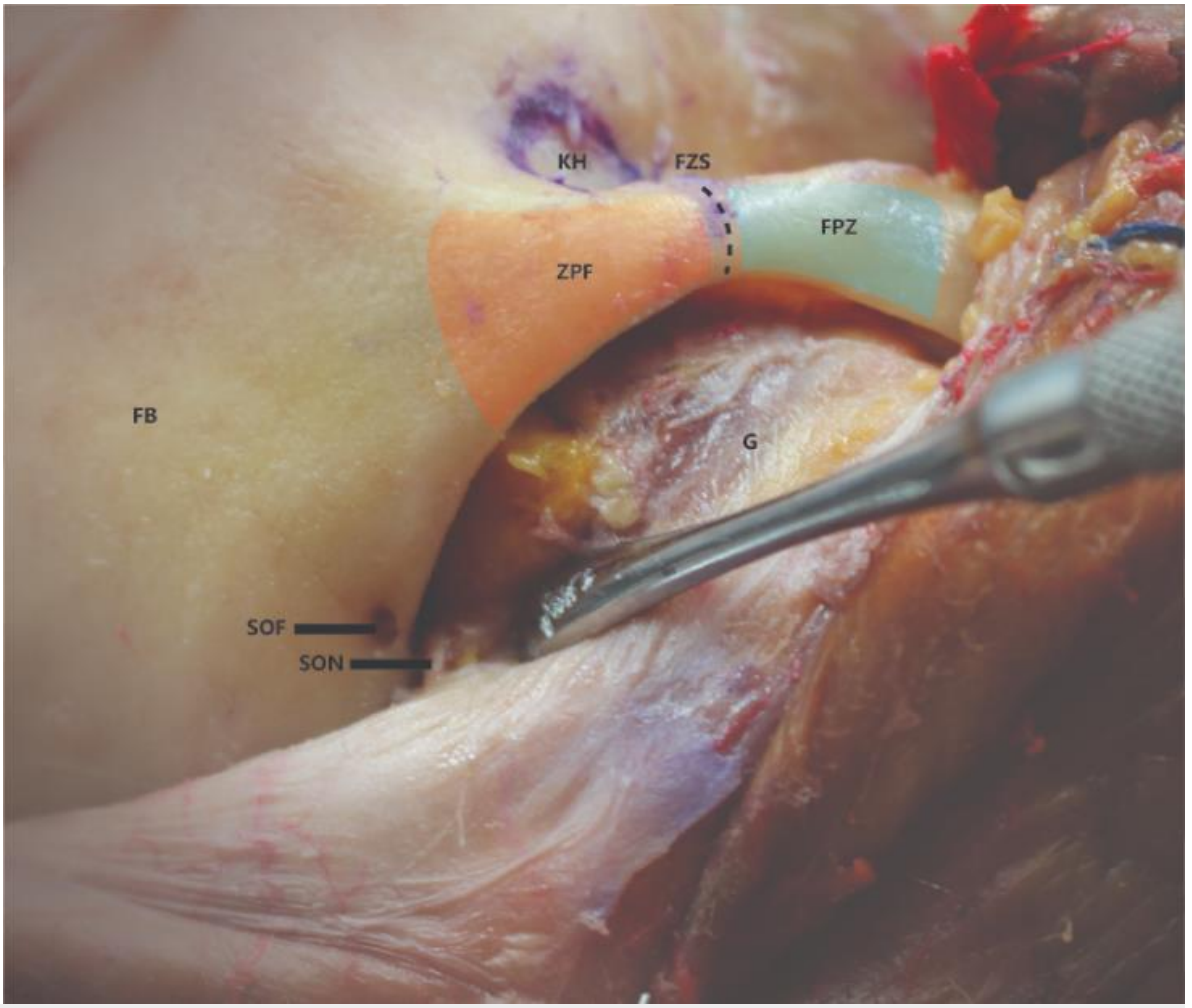


The orbitozygomatic craniotomy cuts.

KH = keyhole
ZPF = zygomatic process of the frontal bone
FPZ = frontal process of the zygomatic bone
FZS = frontozygomatic suture
G = globe
ZA = zygomatic arch

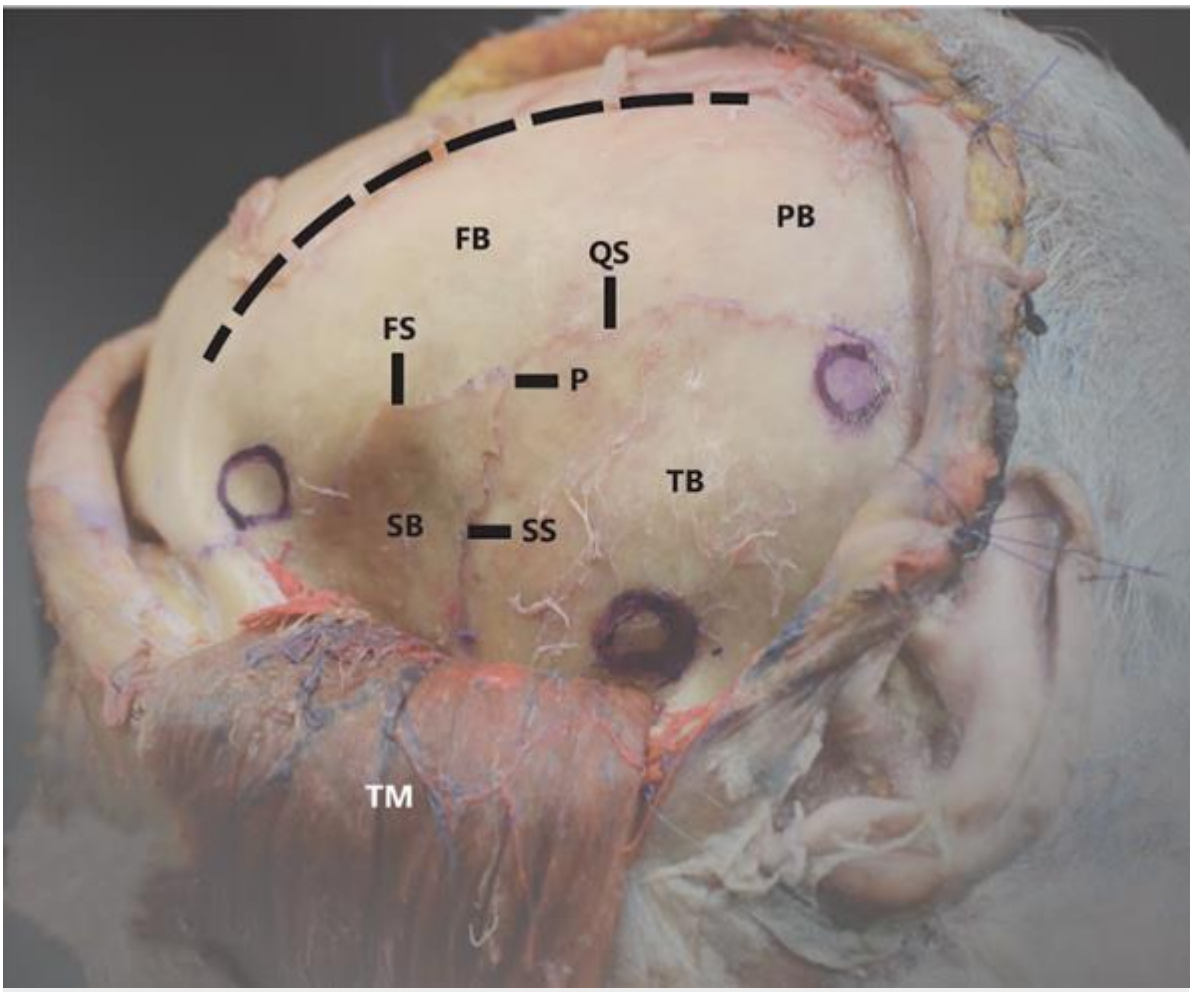
Orange area = frontal bone
Green area = zygomatic process of the frontal bone
Yellow area = frontal process of the zygomatic bone
Red are = zygomatic arch

Purpil area = temporal bone
Pink area = sphenoid bone

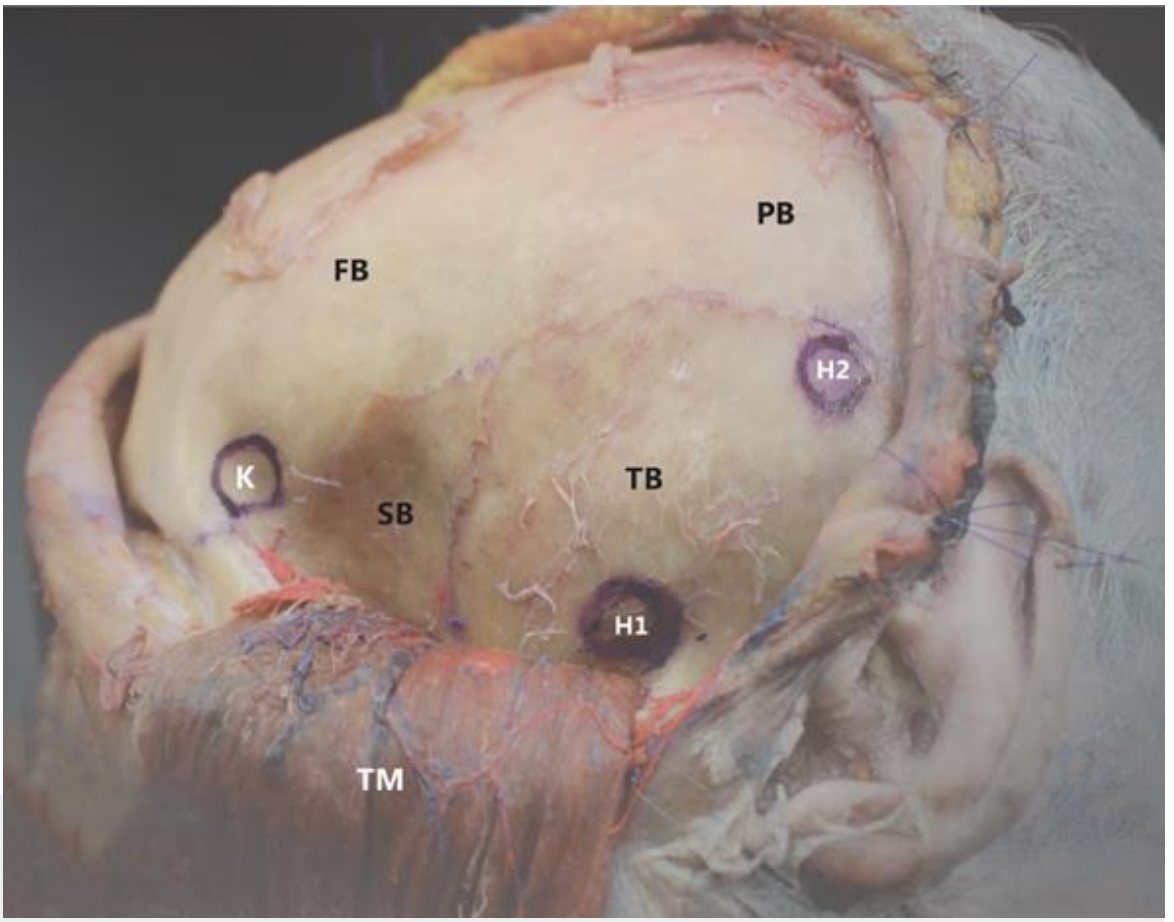


Supraorbital nerve (SON) was dislocated out of the supraorbital foramina (SOF).

FB = frontal bone
KH = keyhole
ZPF = zygomatic process of the frontal bone
FPZ = frontal process of the zygomatic bone
FZS = frontozygomatic suture
G = globe
N = nose

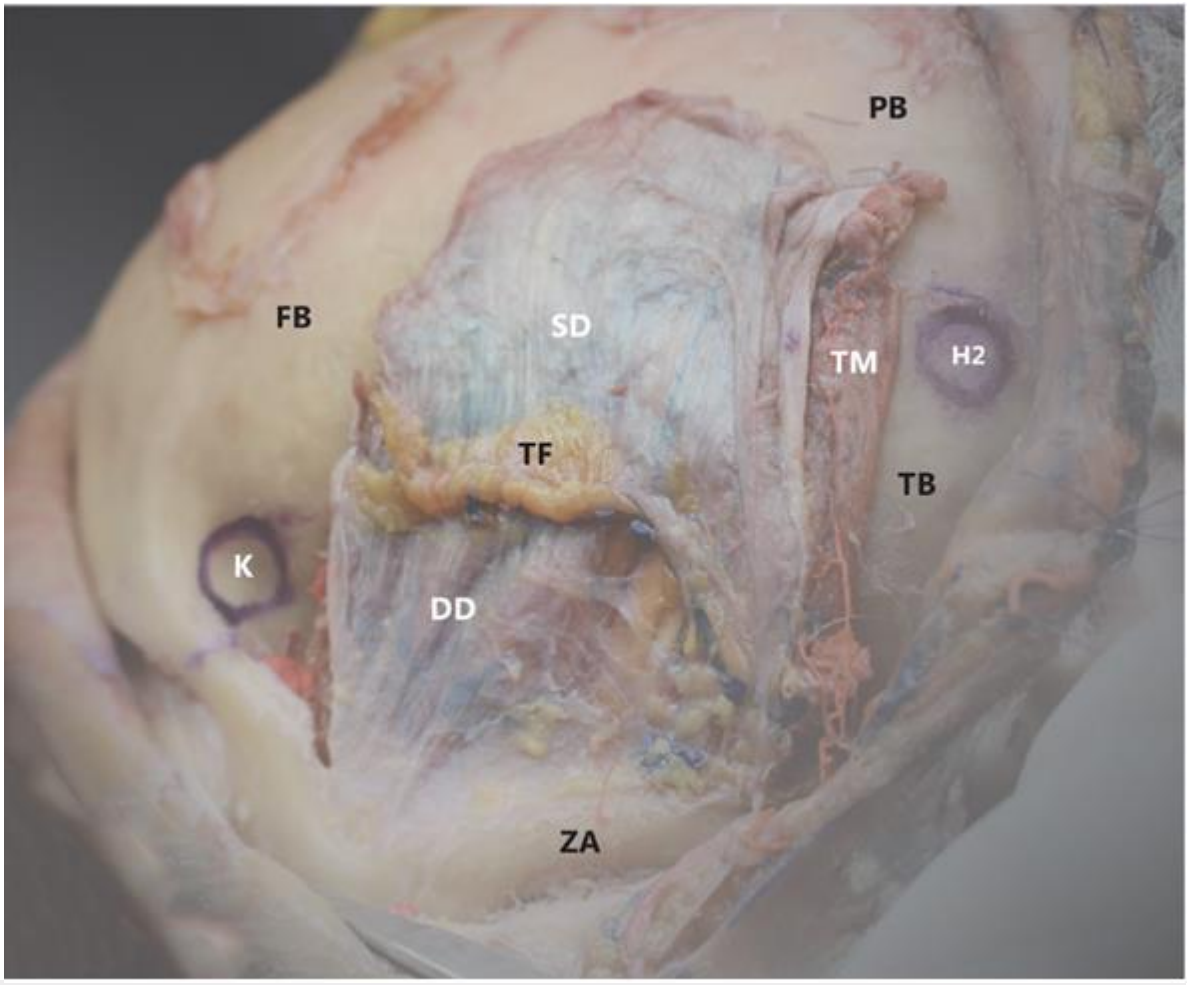


Black dotted line = superior temporal line
FB = frontal bone
PB = parietal bone
SB = sphenoid bone
TB = temporal bone
P = pterion
TM = temporalis bone
FS = frontosphenoid suture
QS = squamous suture
SS = sphenosquamosal suture

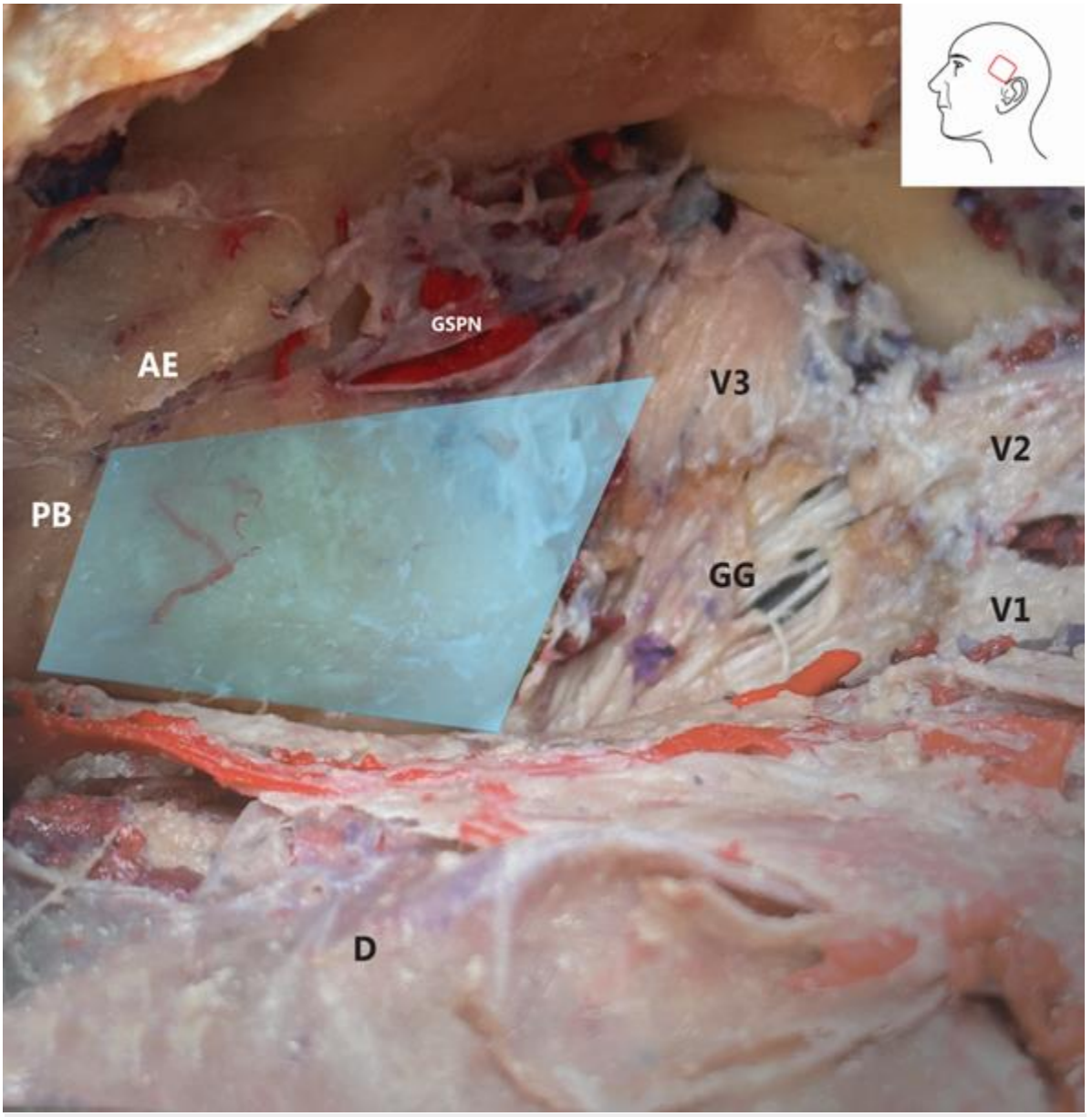


FB = frontal bone
PB = parietal bone
SB = sphenoid bone
TB = temporal bone
TM = temporal bone
K = MacCarty keyhole
H1 = first burr hole located above the posterior root of the zygomatic bone
H2 = second burr hole on the temporal bone over the squamous suture

FB = frontal bone
SN = supraorbital nerve
K = MacCarty keyhole
OF = orbital fat
TM = temporalis muscle



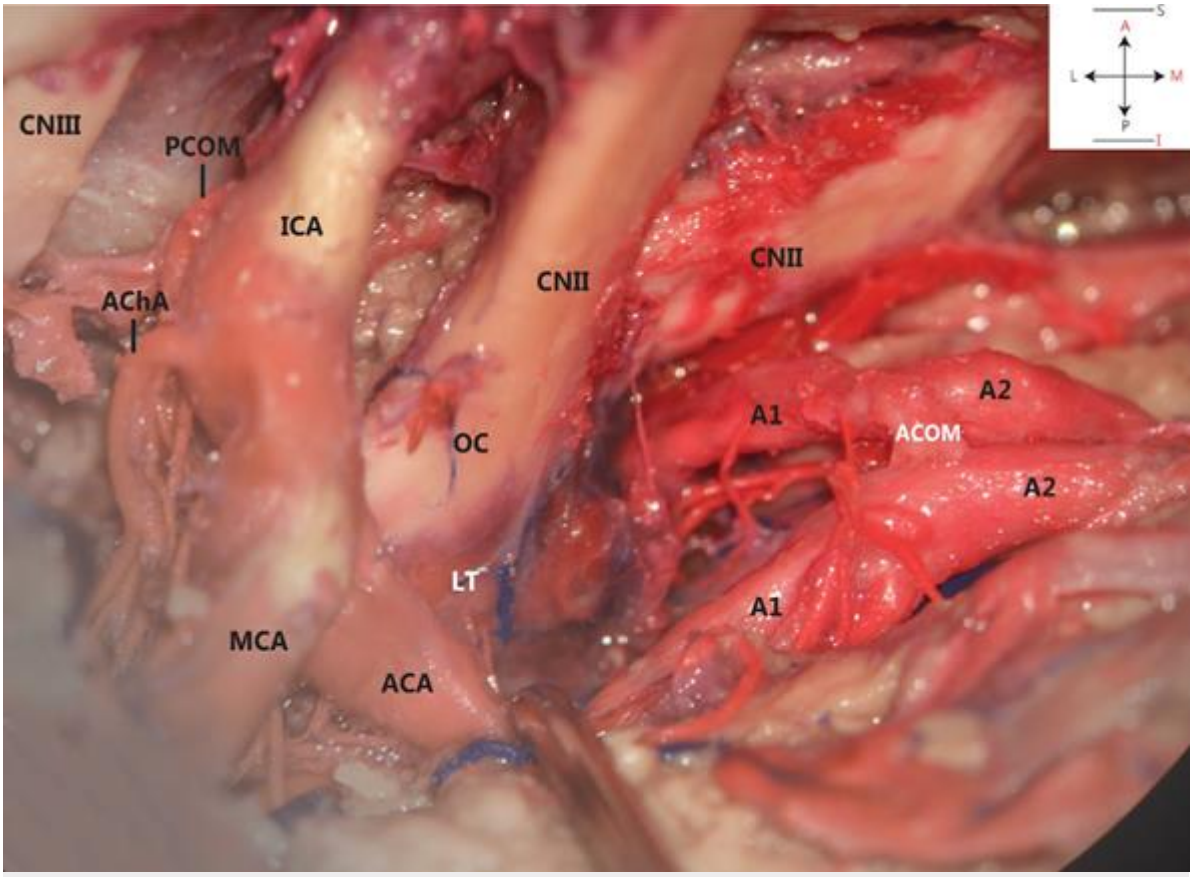
K = MacCarty keyhole
H2 second burr hole on the temporal bone over the squamous suture
FB = frontal bone
PB = parietal bone
TB = temporal bone
TM = temporal bone
SD = superficial layer of the deep temporal fascia
DD = deep layer of the deep temporalis fascia
FT = temporal fat pad
ZA = zygomatic arch



Petrous bone anatomy - Rhomboid area showing middle part of petrous bone.

GG = gasserian ganglion
AE = arcuate emmeinanc
PB = petrosal bone
Blue highlight = Rhomdoid area
GSPN = greater superfacial petrosal nerve

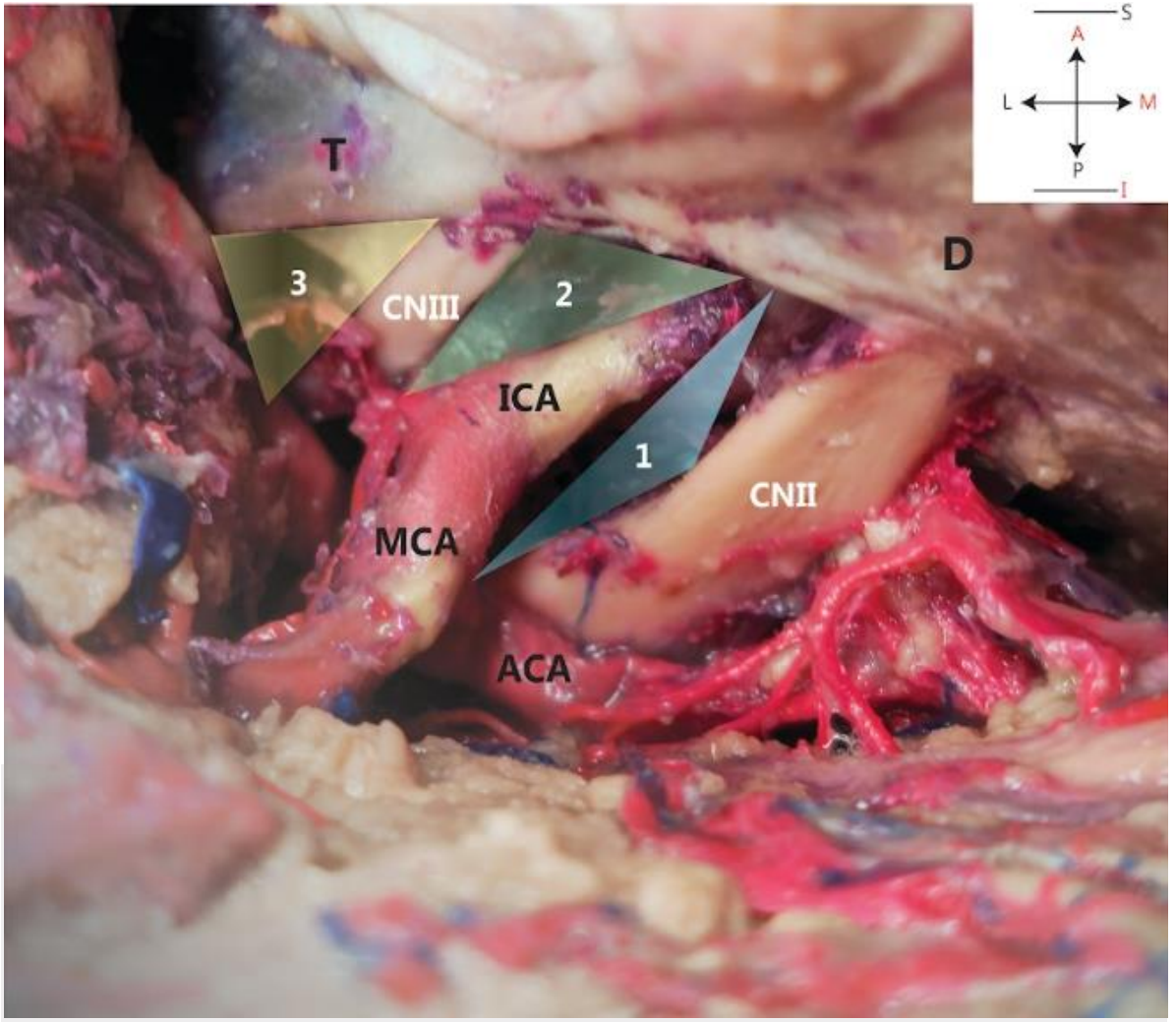
V1 = opthalamic branch of the trigeminal nerve
V2 = maxillary branch of trigeminal nerve
V3 = mandibular
AC = anterior clinoid process
D = dura matter



ICA = internal carotid artery
MCA = middle cerebral artery
ACA = anterior cerebral artery
A1 = pre- communicating segment of anterior cerebral artery

CNII = optic nerve
A2 = post-communicating segment of anterior cerebral artery
ACOM = anterior communicating artery
LT = lama terminalis

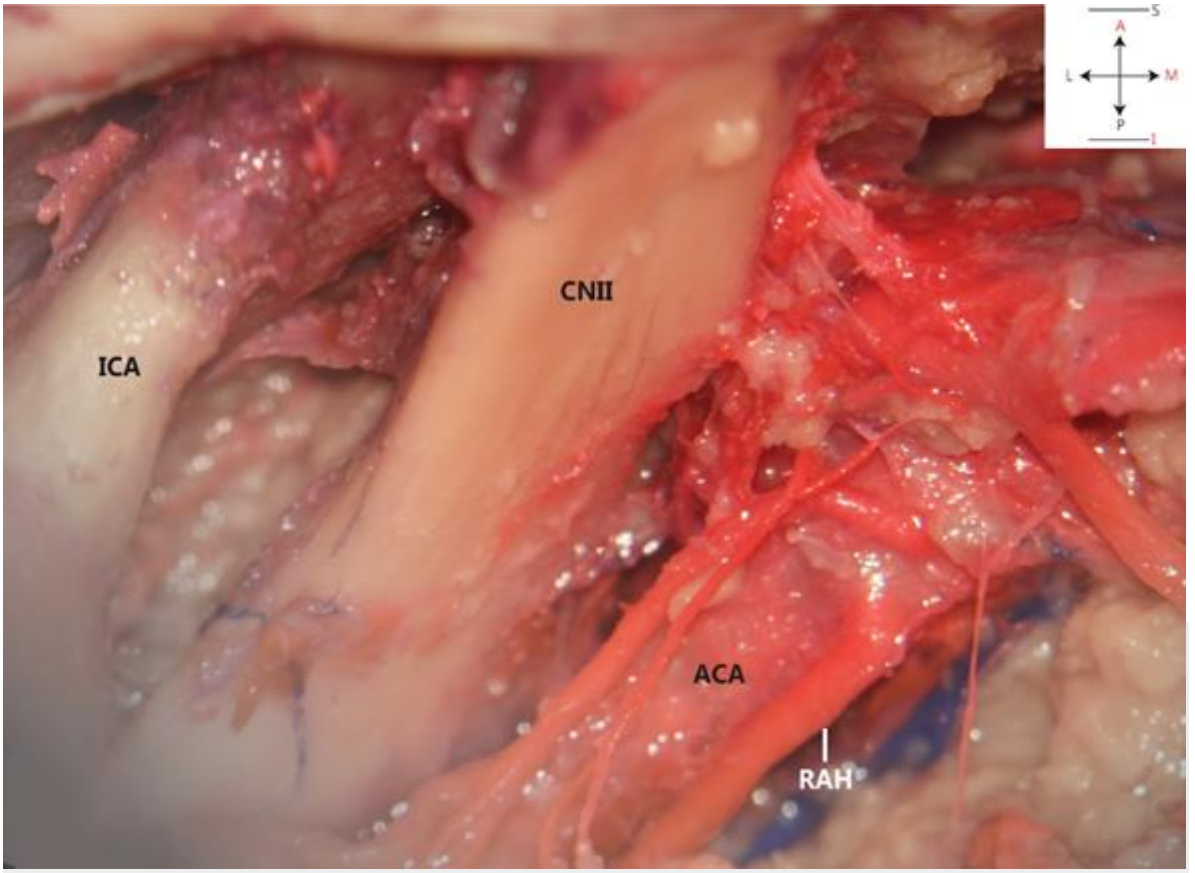
OC = optic chiasm
PCOM = posterior communicating artery
AChA = anterior choroidal artery



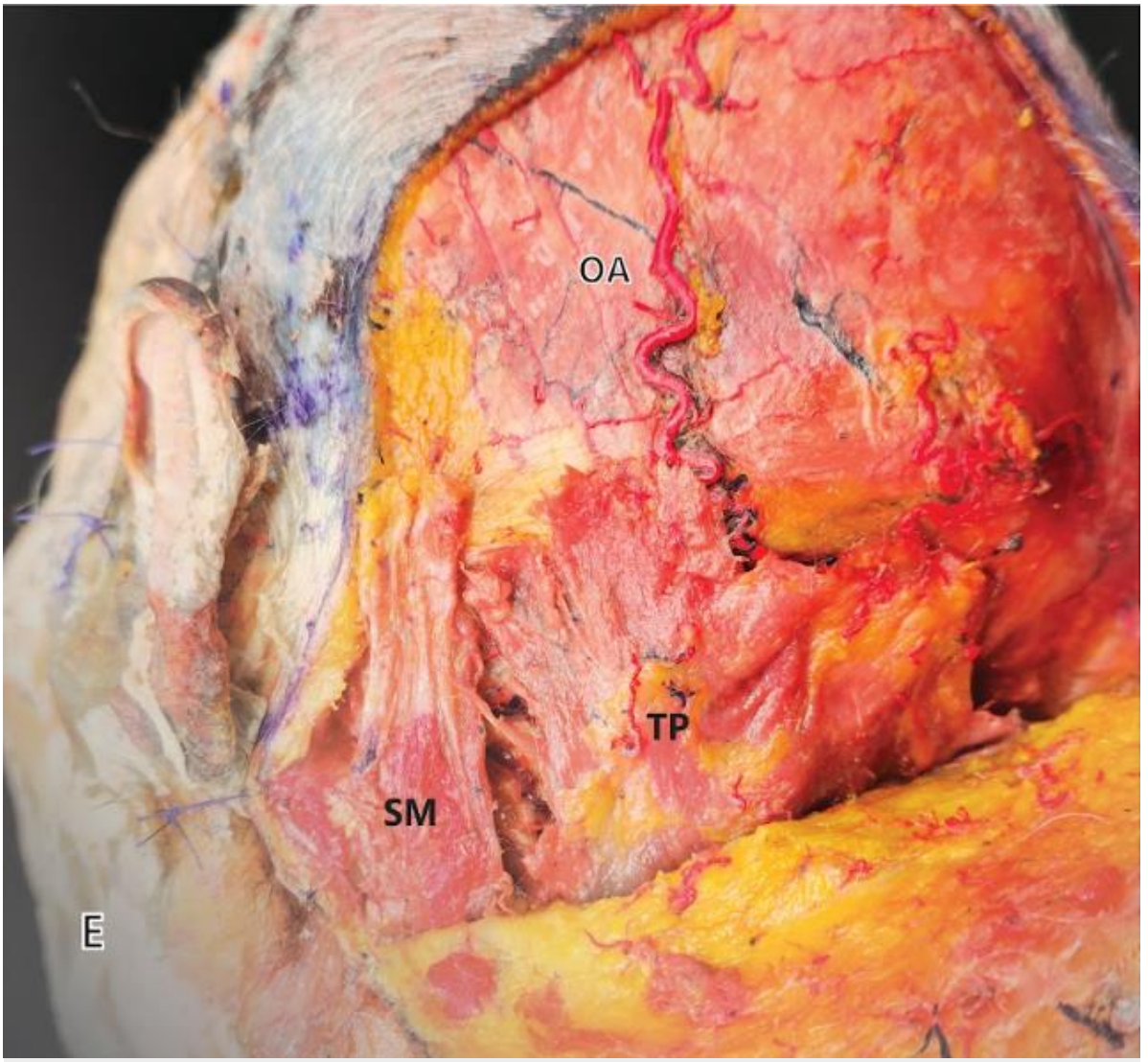
1 = optico-carotid triangle
2 = oculomotor-carotid triangle
3 = oculomotor-tentorial triangle

CNIII = oculomotor nerve
CNII = optic nerve
ICA = internal carotid artery

ACA = anterior cerebral artery
MCA = middle cerebral artery
T = tentorium
D = dura matter



ICA = internal carotid artery
ACA = anterior cerebral artery
CNII = optic nerve
RAH = recurrent artery of heubner

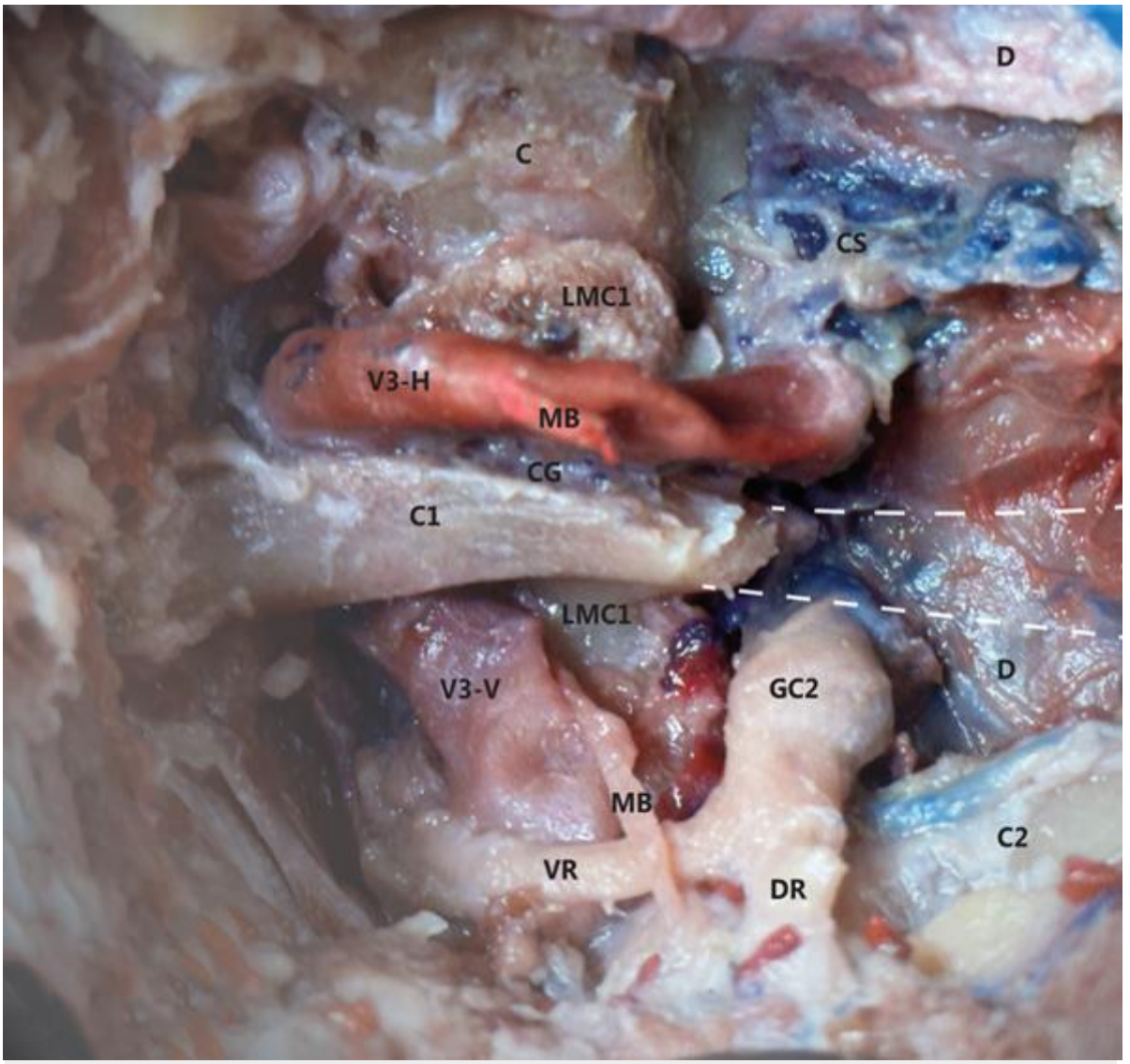


SM = sternocleidomastoid muscle
TP = trapezius muscle
OA = occipital artery

C1 = posterior arch of C1 vertebra (post-laminectomy)
GC2 = ganglion of C2
C2 = C2 vertebra
CG = occipital condyle groove.

V3-V = vertical branch of vertebral artery
V3-H = horizontal branch of vertebral artery
VR = ventral ramus
DR = dorsal ramus
C = occipital condyle bone
D = dura matter

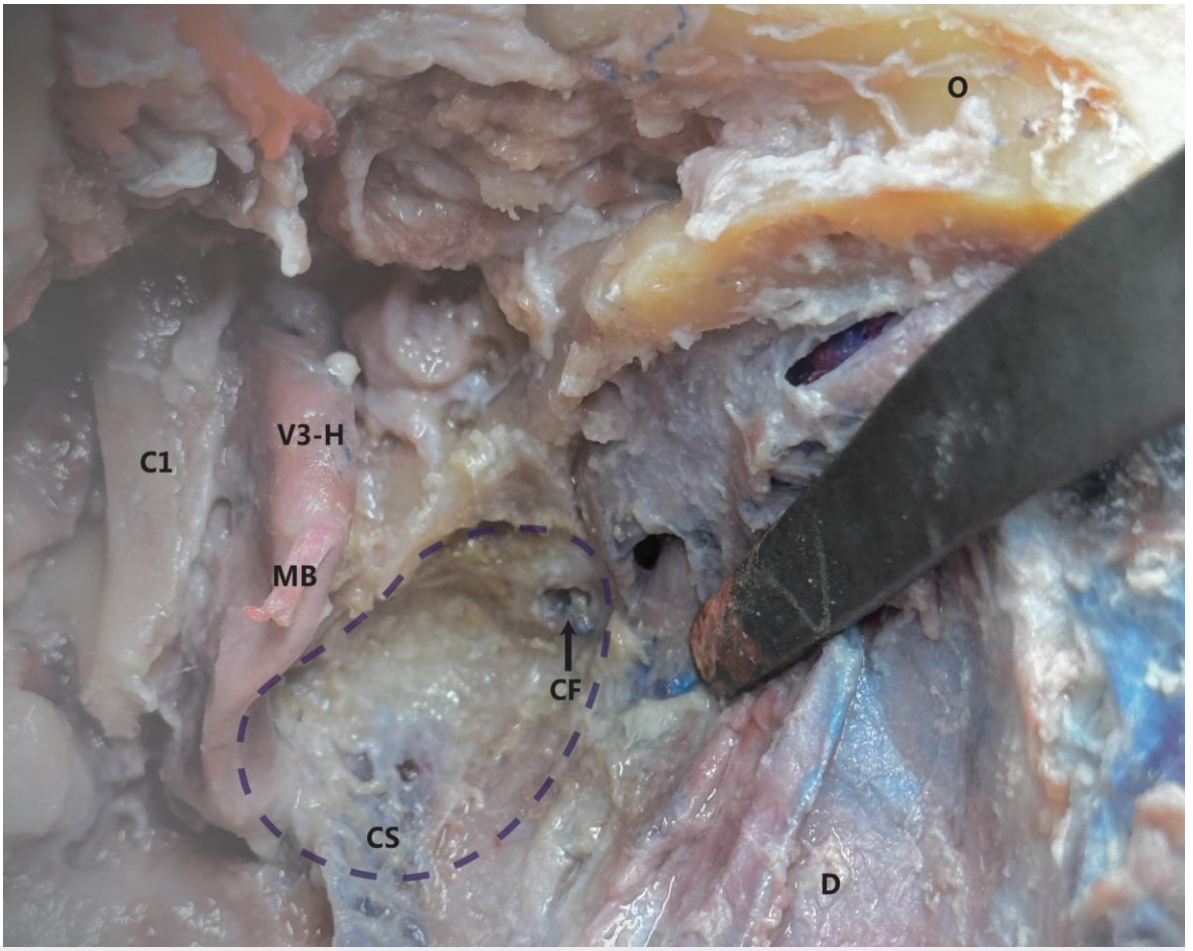
MB = muscular branch of vertebral artery
LMC1 = lateral mass of C1
White dashed line is atlantooccipital joint



C1 = posterior arch of C1 vertebra (post-laminectomy)
GC2 = ganglion of C2

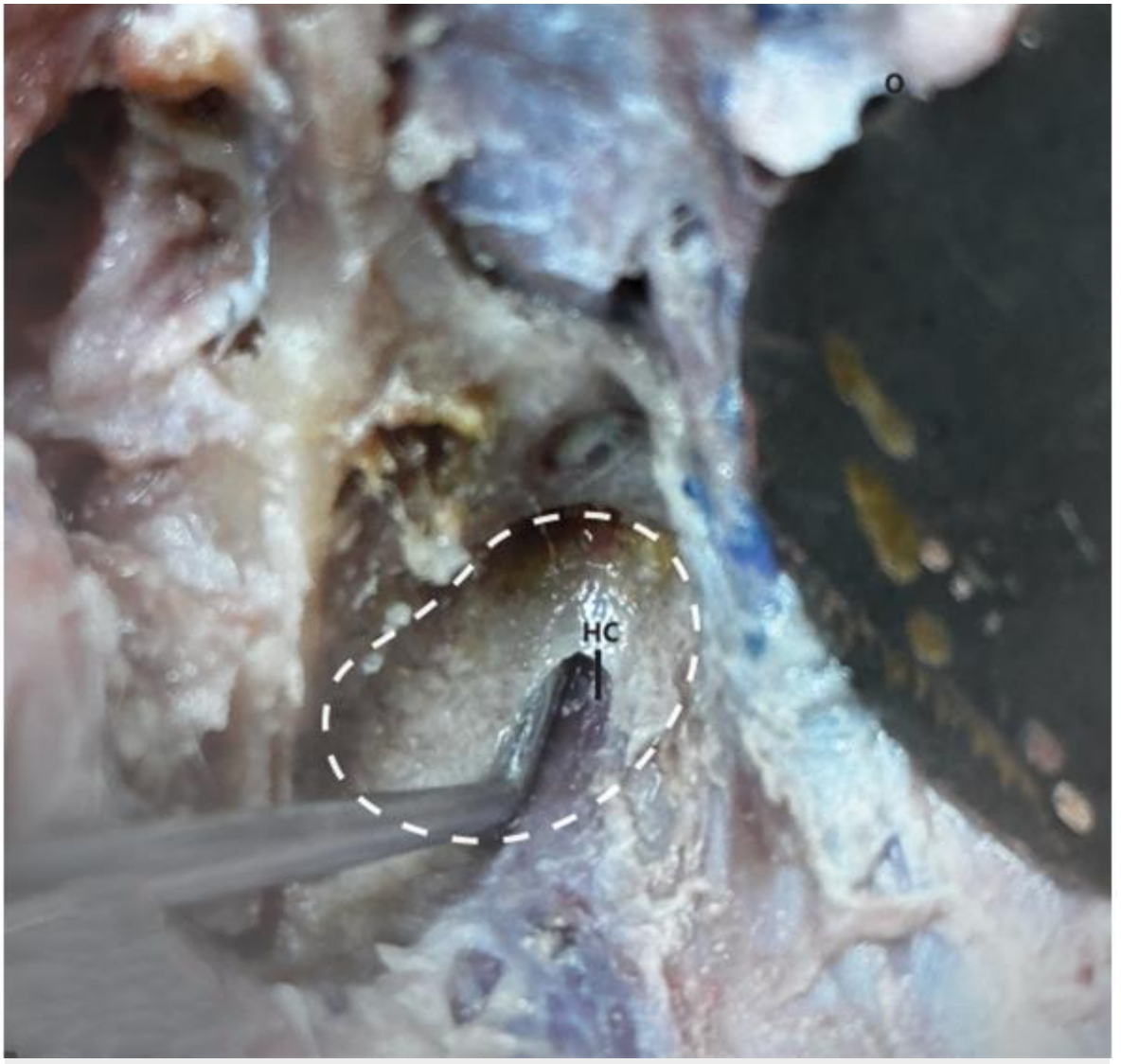
V3-V = vertical branch of vertebral artery
V3-H = horizontal branch of vertebral artery
VR = ventral ramus
DR = dorsal ramus
C = occipital condyle bone
D = dura matter
MB = muscular branch of vertebral artery

LMC1 = lateral mass of C1
White dashed line represents the laminectomy
C2 = C2 vertebra
CG = occipital condyle groove
CS = circular sinus.

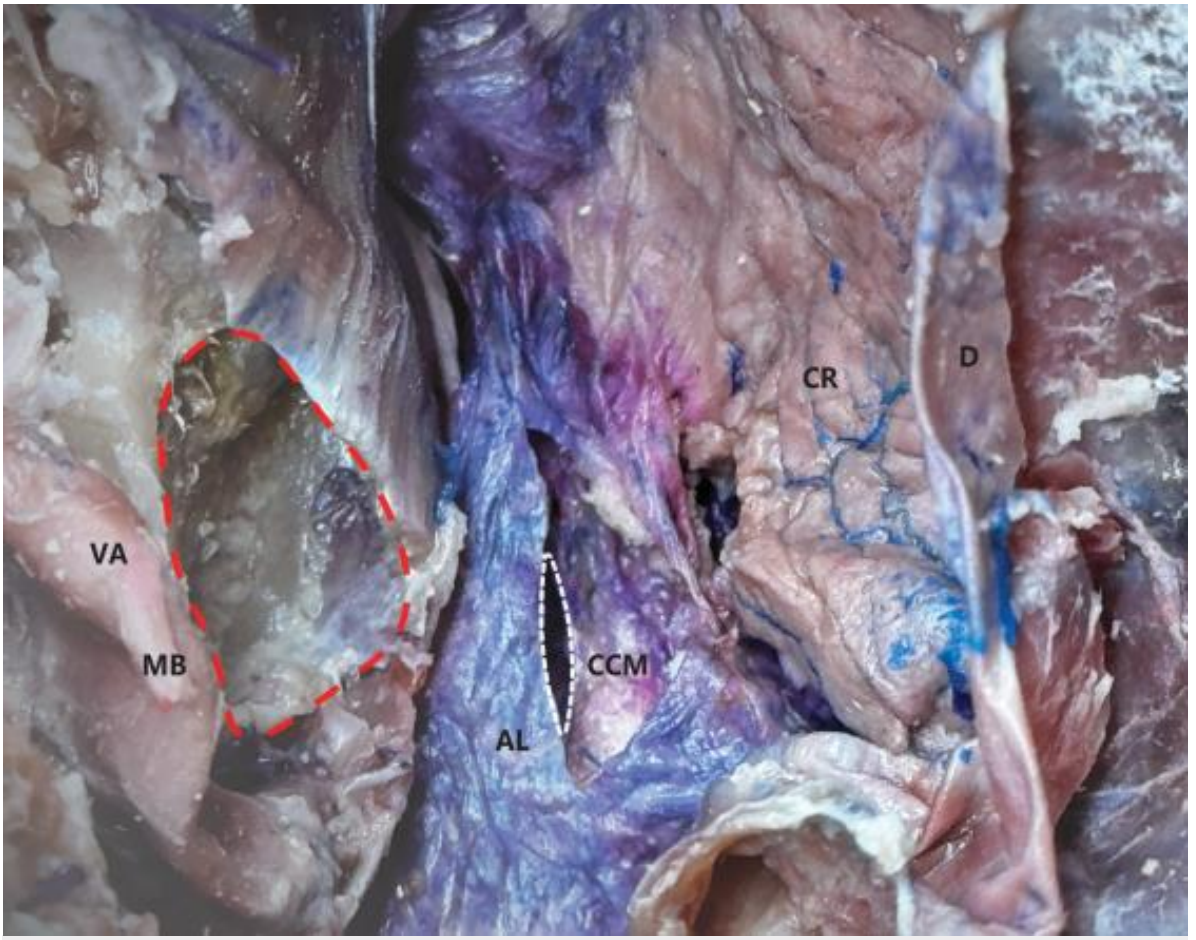


Partial condylectomy

CF = condylar vein
C1 = posterior arch of C1 vertebra (post-laminectomy)
MB = muscular branch of vertebral artery
V3-H = horizontal branch of vertebral artery
D = dura matter
O = occipital bone
CS = circular sinus

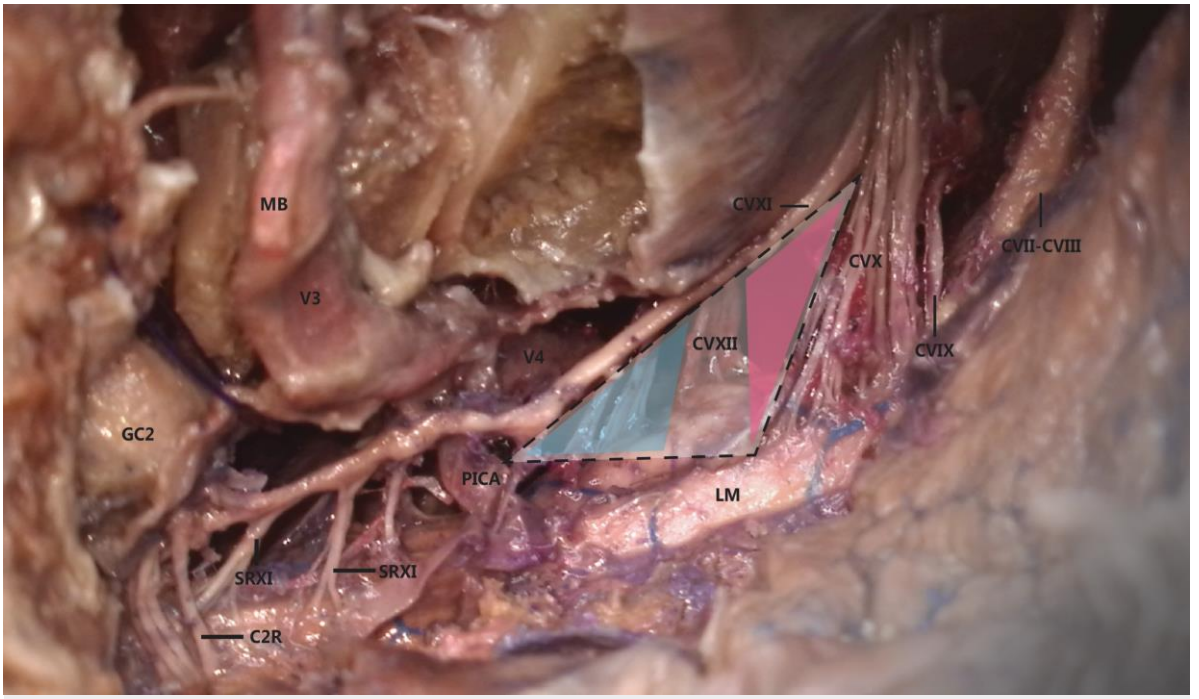


Partial condylectomy. Hypoglossal canal (HC) was exposed.



Partial condylectomy was done for better lateral exposure (red dashed line)

VA = vertebral artery
MB = muscular branch of vertebral artery
AL = arachnoid layer
CR = cerebellum
D = dura matter
White dashed line highlight the cerebullo-medullary cistern (CCM)



MB = muscular branch of vertebral artery
V3 = third segment of vertebral artery
V4 = fourth segment of vertebral artery

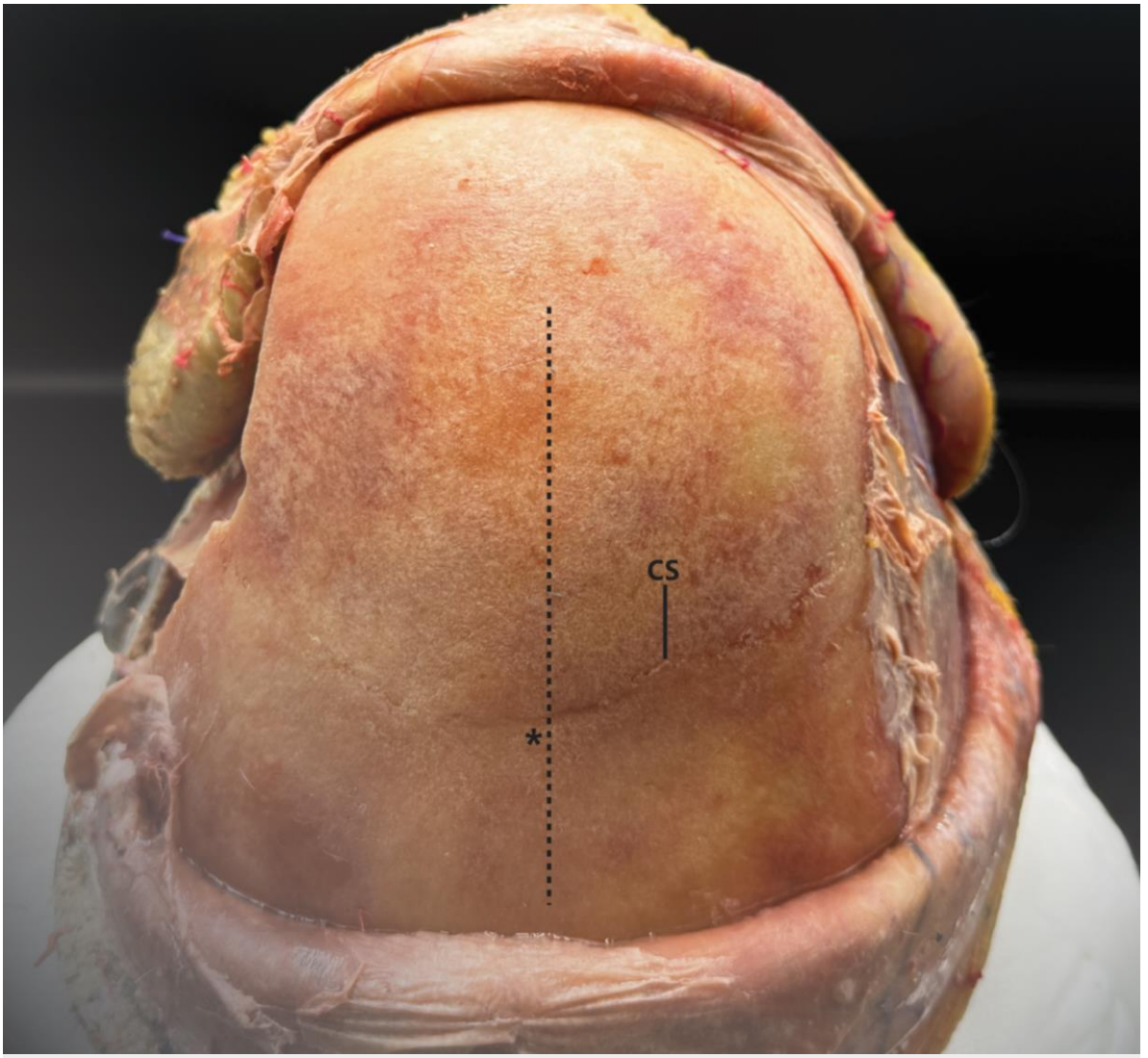
GC2 = C2 ganglion
C2R = roots of C2
PICA = posterior inferior cerebullar artery
LM = lower medulla
CVII-CVIII = facial and vestib-ulocochlear complex
CVIX = glossopharyngeal nerve
CVXII = hypoglossal nerve
CVXI = accessory nerve
CVX = vagus nerve

SRXI = spinal roots of accessory nerve

Grey highlight is the vago-accessory triangle

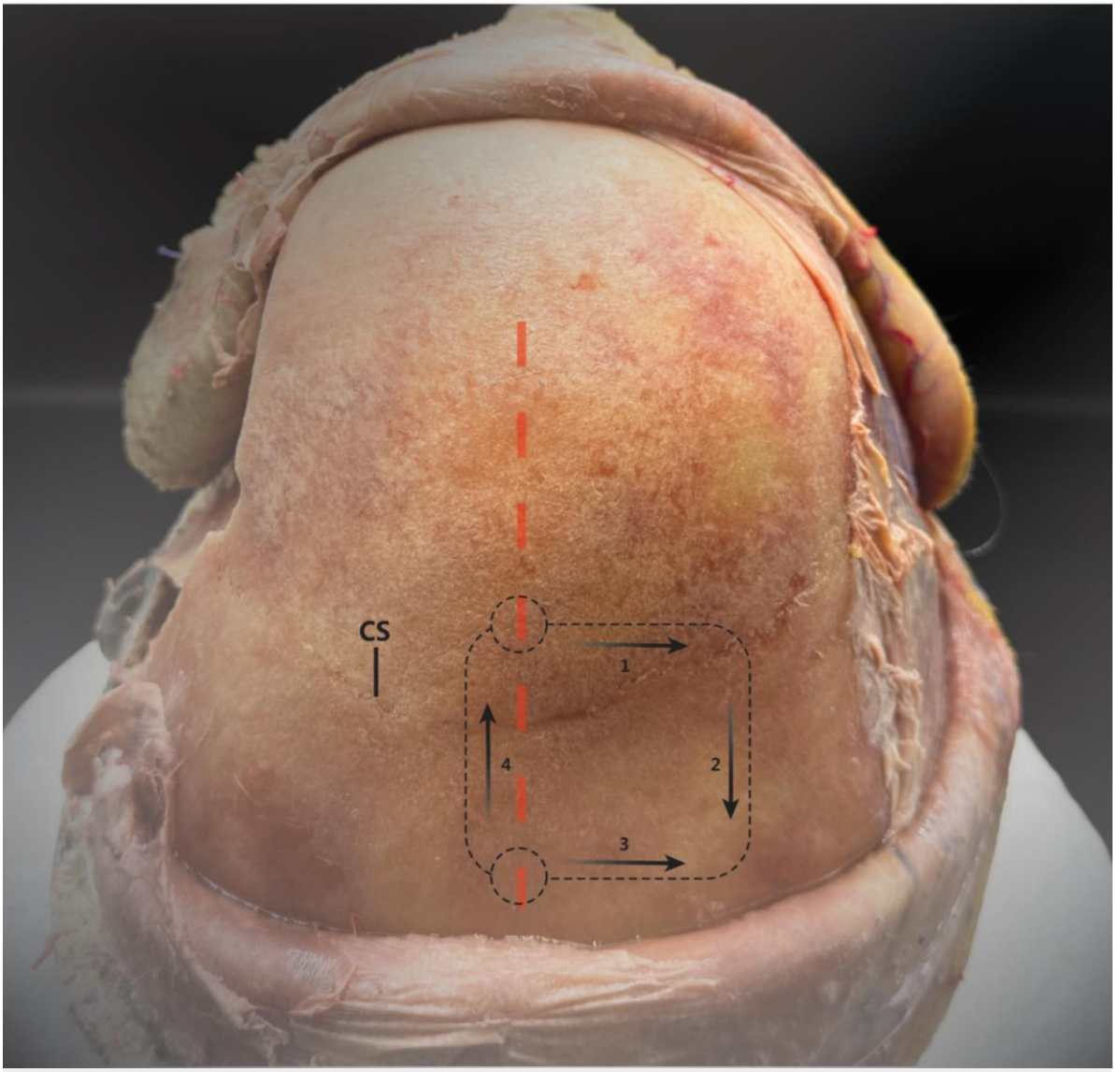
Red highlight is the supra-hypoglossal triangle

Blue highlight is the infra-hypoglossal triangle.

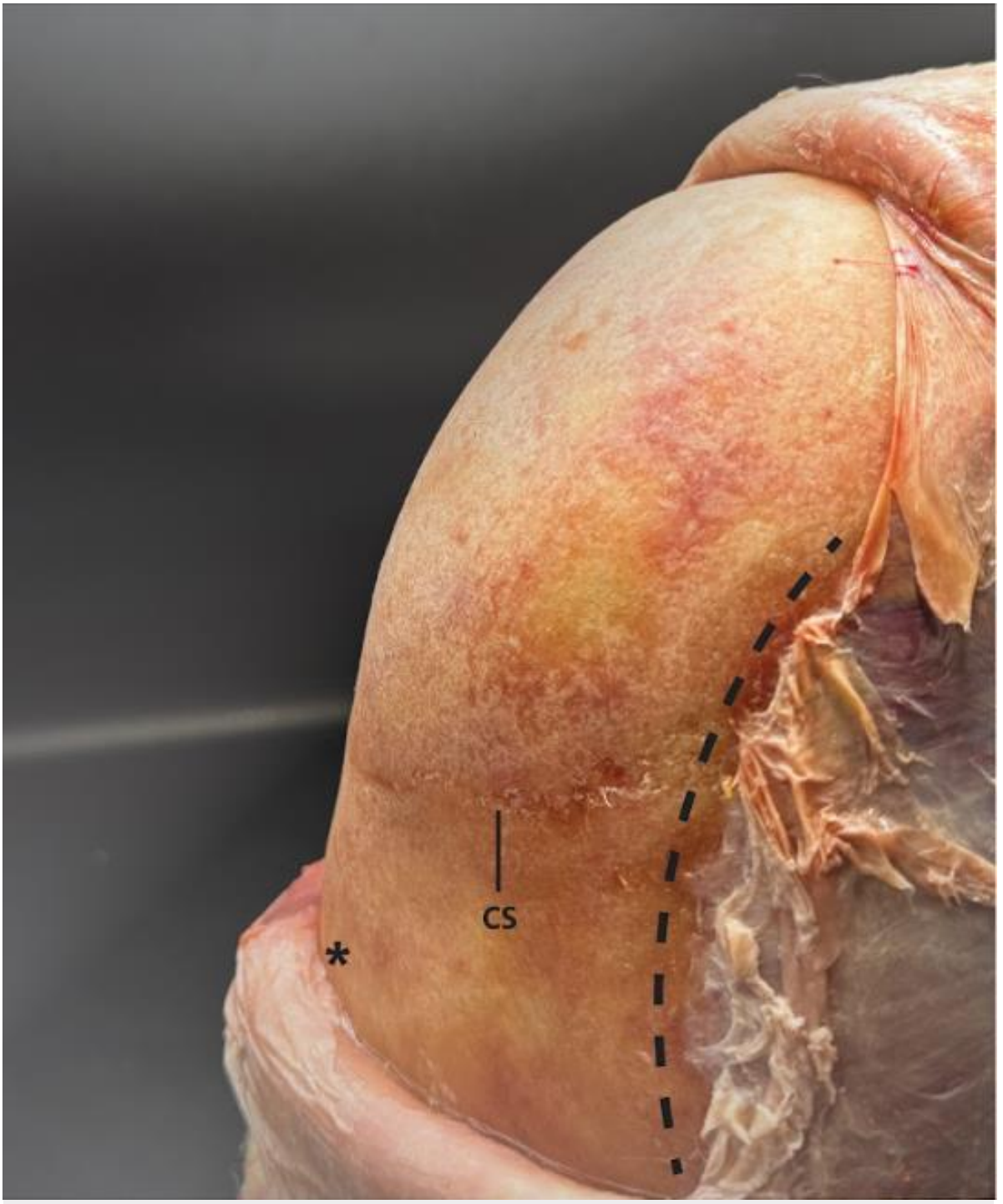


The black dashed line is the vertex
CS = coronal suture

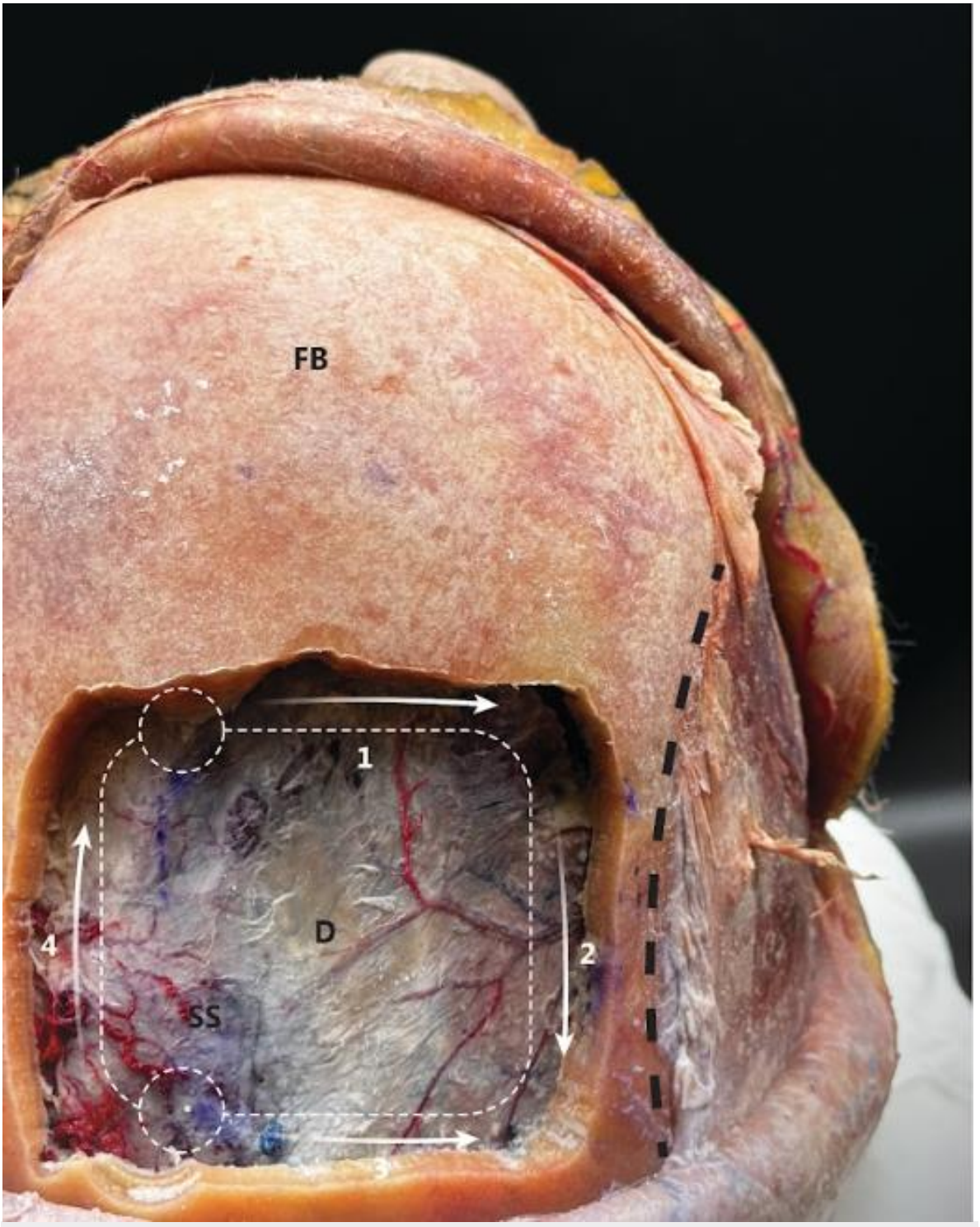
Asterisk showing the bregma
No sagittal suture clearly observed in this specimen



Craniotomy course
CS = coronal suture

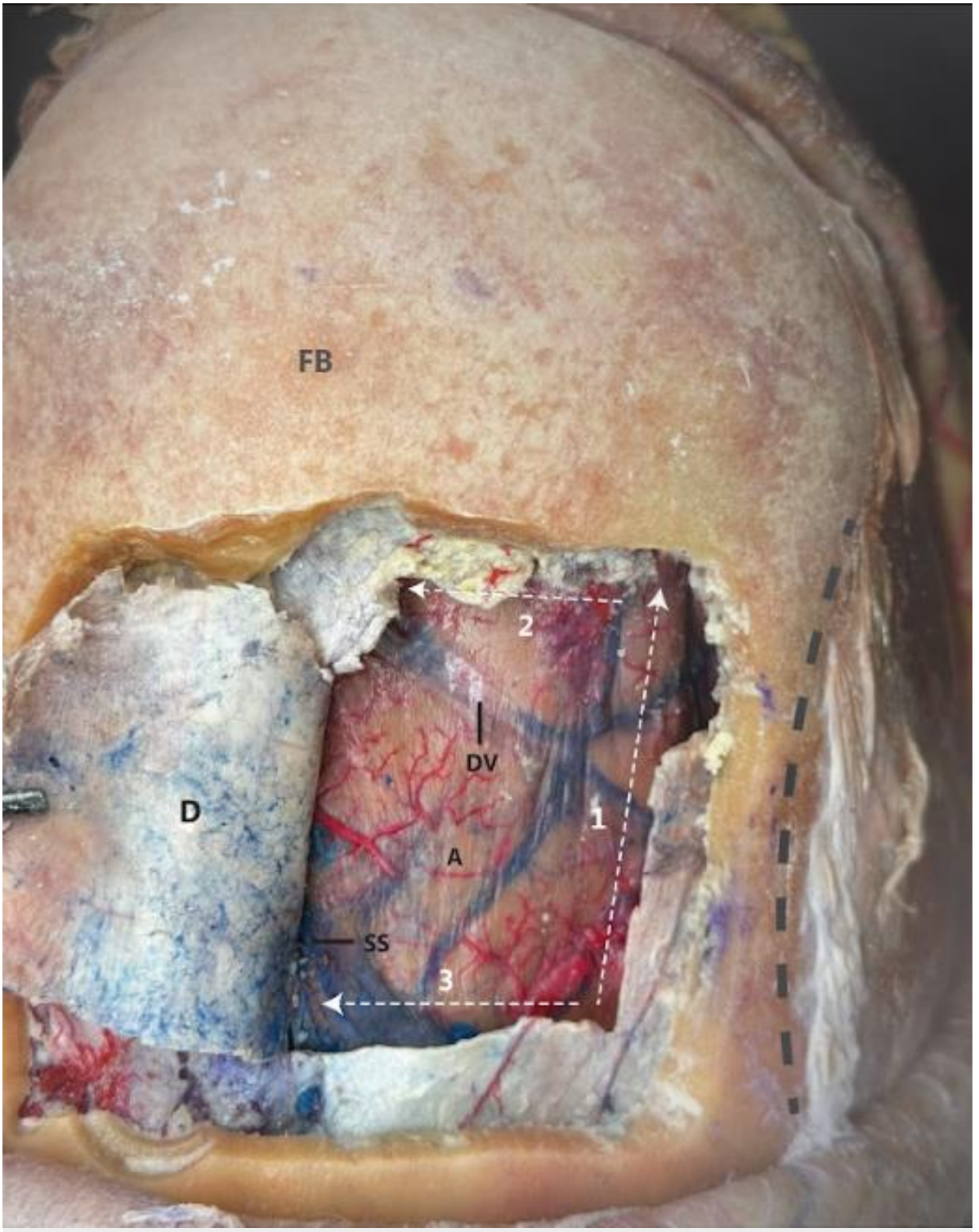


Asterisk = vertex
CS = coronal suture



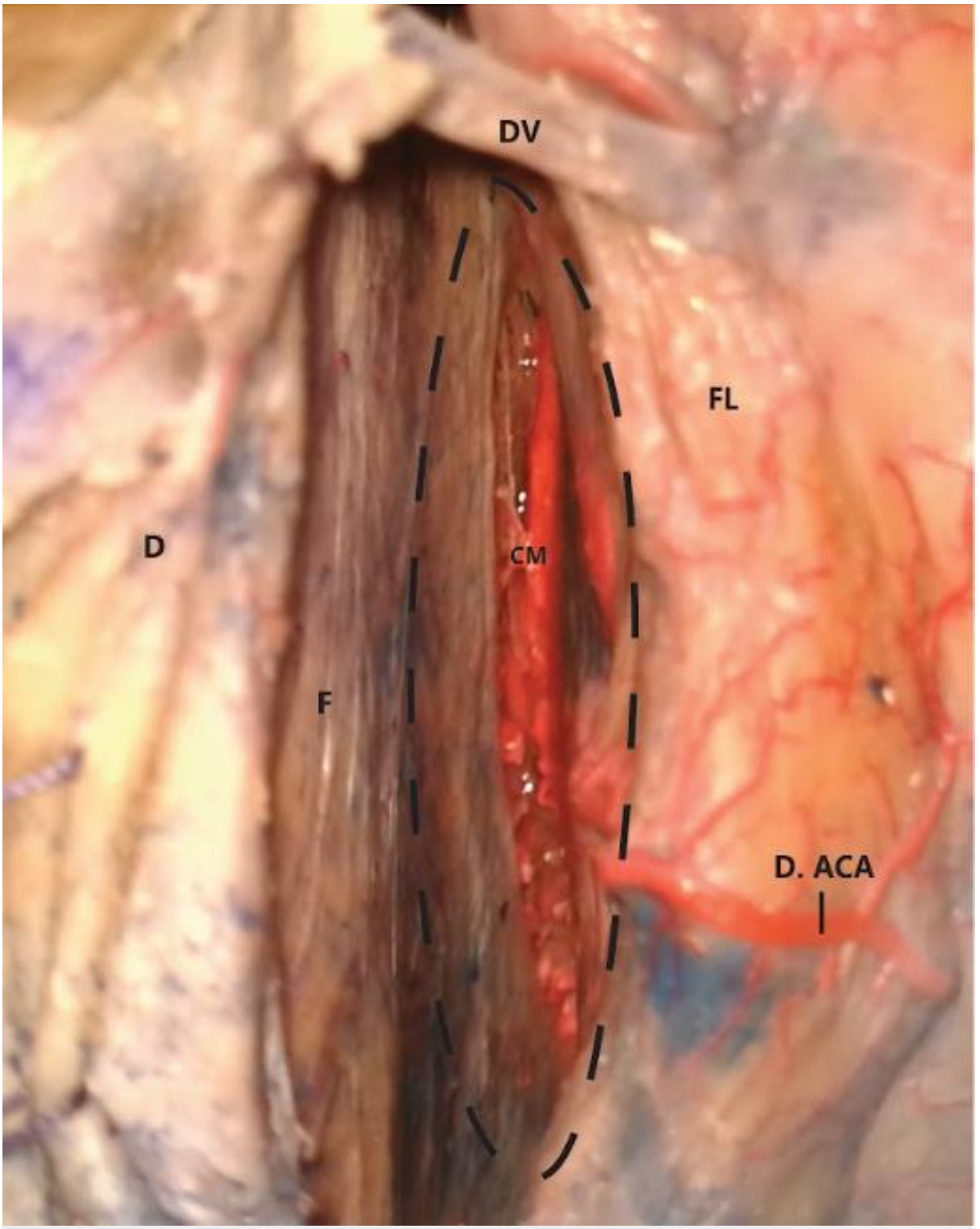
Craniotomy course.

The black dashed line is the superior temporal line
D = dura matter
SS = sagittal sinus

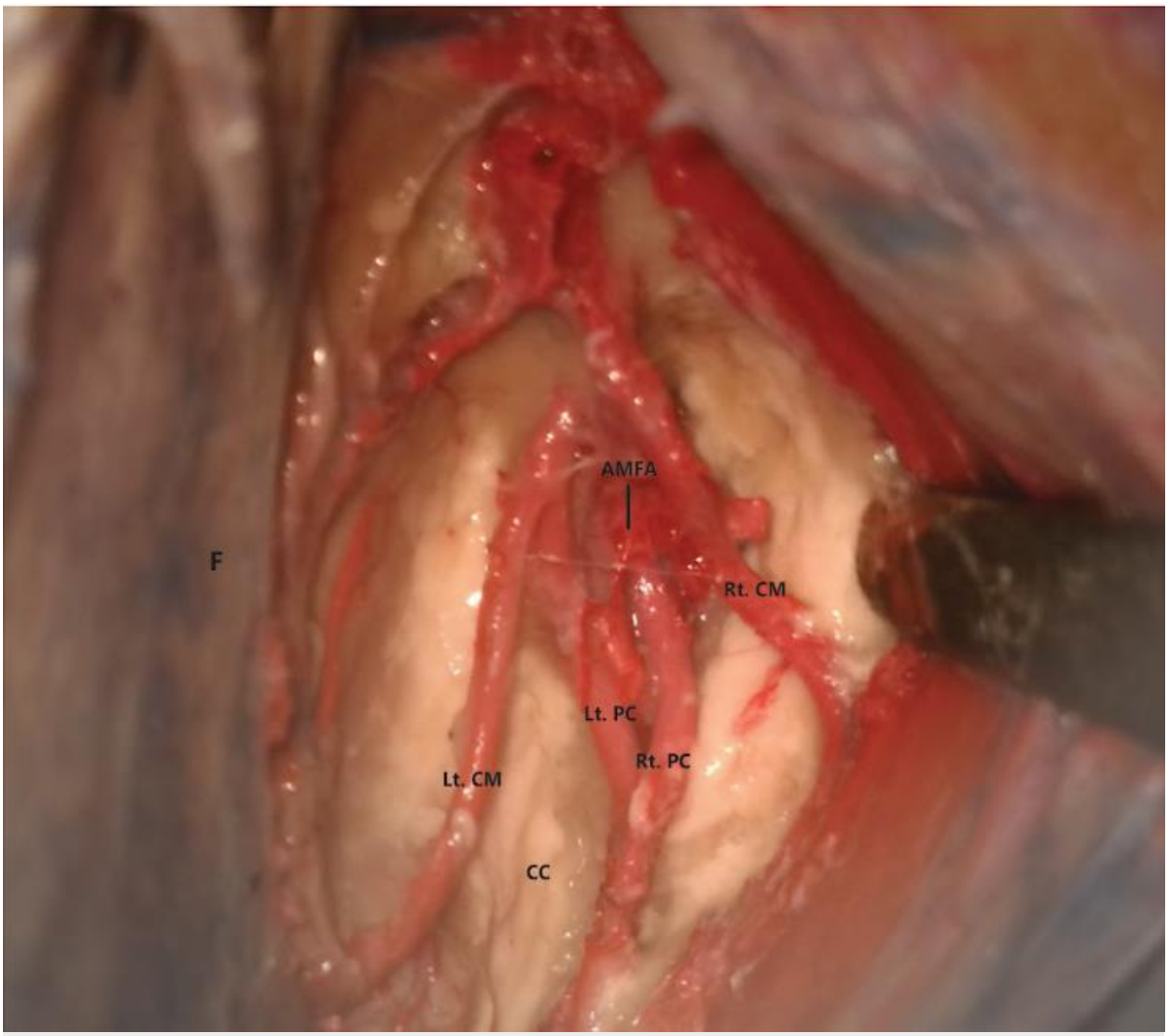


The white dashed line is the cut of the dura mater (D)
The black dashed line is the superior temporal line
DV = draining veins
SS = sagittal sinus
A = arachnoid
FB = frontal bone

The white dashed line is the sagittal sinus (SS)
The black dashed line is the superior temporal line
DV = draining veins
AB = arachnoid band
A = arachnoid layer

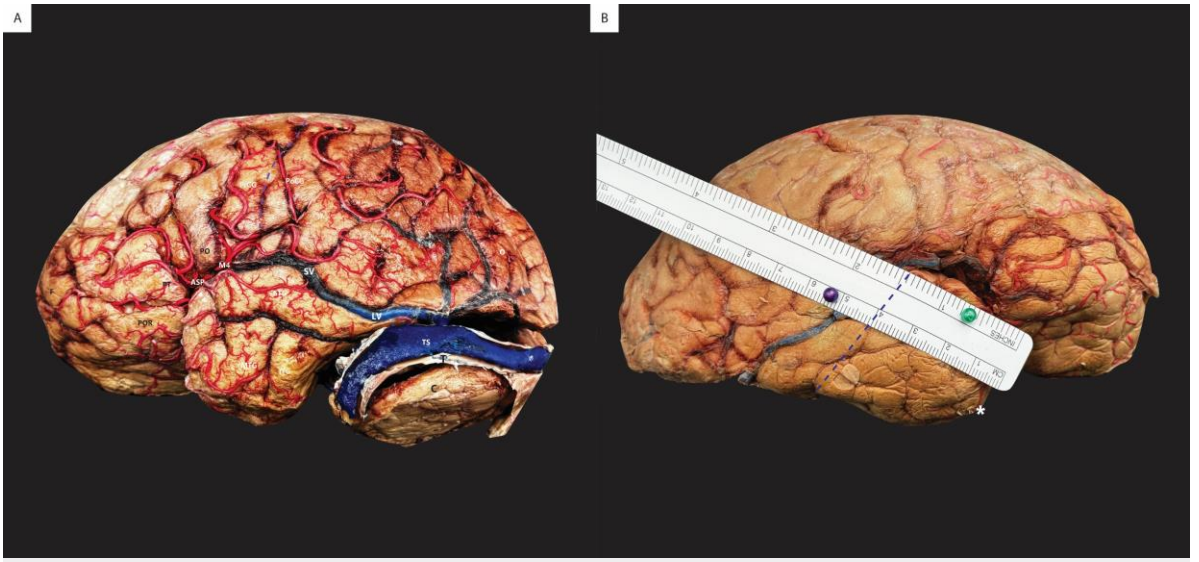


FL = frontal lobe
DV = draining veins
D = dura matter
D. ACA = distal anterior cerebral artery
IHF = intrahemispheric fissure
F = falx
CM = Cingulate margin



PC = pericallosal artery
CM = calloso-marginal artery
CC = corpus callosum

F = falx
AMFA = anterior medial frontal artery



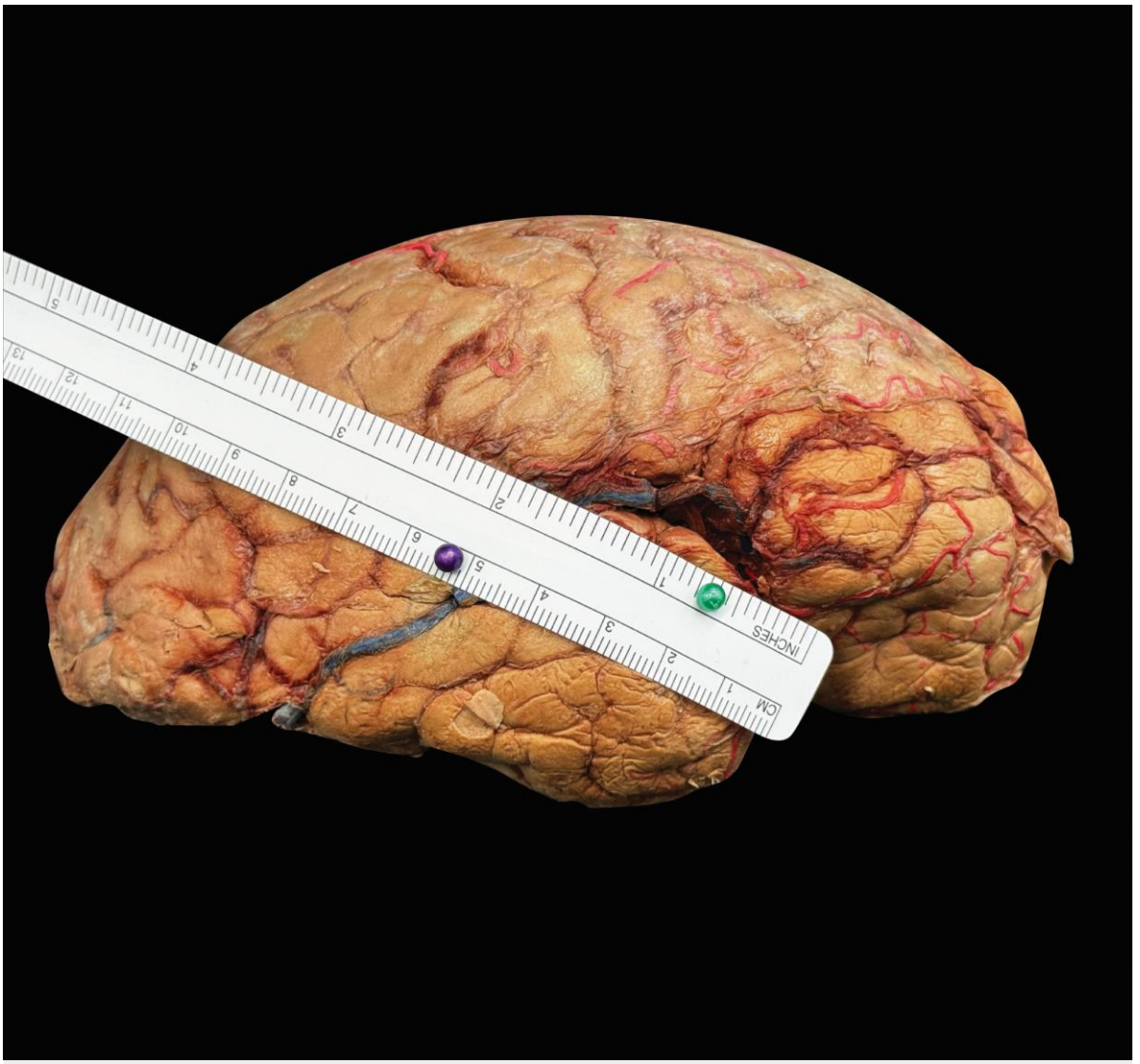
(A) Step I: Identification of Sylvian fissure;-
I - Note the M4 segment of MCA as it exits the Sylvain fissure.
II - The orientation of the frontal lobe gyri is vertical in contrast to the temporal gyri, which is horizontal.
III - Through the superficial Sylvian vein (not-relaible).
IV-Through sphenoid ridge separating frontal & temporal lobes (not demonstrated).

(B) Step II: A 4-5 cm cut measured from the temporal pole parallel to the middle temporal gyrus (right side).
If left side 3.5-4 cm preferably.

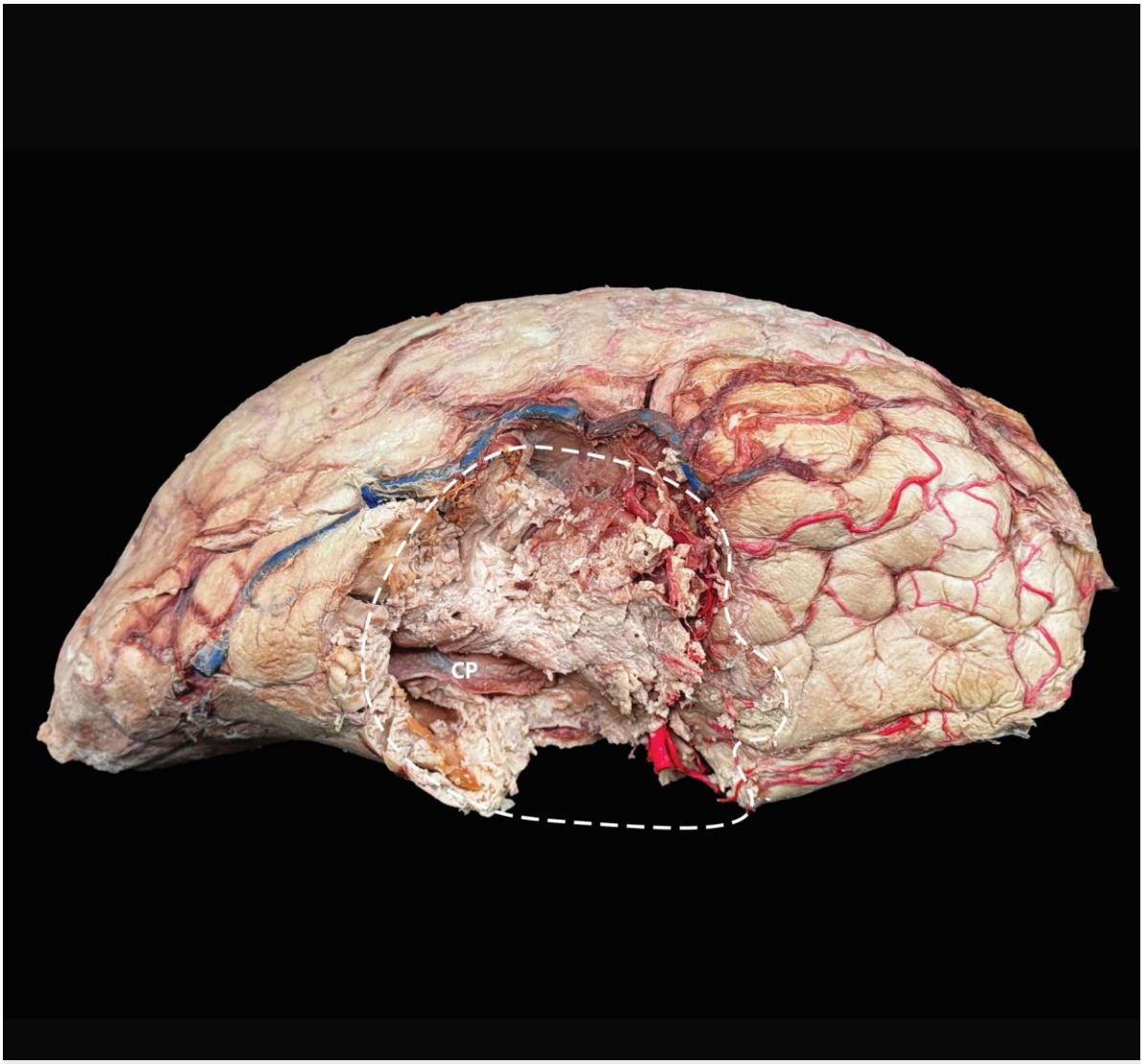
C = cerebellum
F = frontal lobe
PT = pars triangularis
POR = pars orbitalis
PO = pars opercularis
SV = Sylvian vein
LV = vein of Labbe

PrCG = precentral gyrus
POCG = postcentral gyrus
O = occipital lobe
TS = transverse sinus
STG = Superior temporal gyrus
ITG = Inferior temporal gyrus
MTG = Middle temporal gyrus
ASP = Anterior Sylvian point
Yellow dashed line = postcentral sulcus
White dashed line = parietal-temporal imaginary line

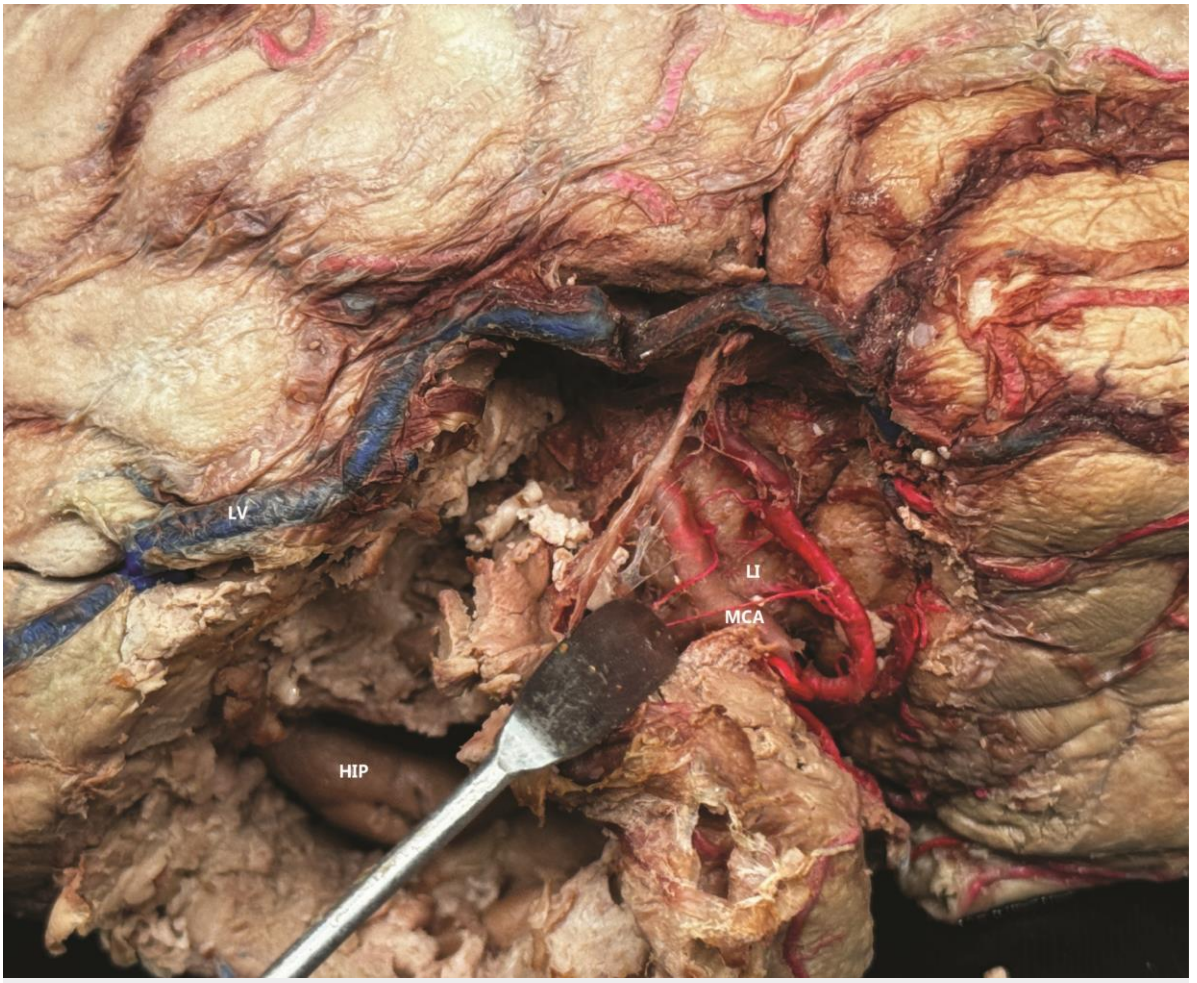
M4 = cortical segment of the middle cerebral artery
Green dashed line = Sylvain fissure
Blue dashed line = horizontal ramus of Sylvain fissure
Orange dashed line = ascending ramus of Sylvain fissure
Grey dashed line = precentral sulcus
Purple dashed line= central sulcus
Asterisk = temporal pole



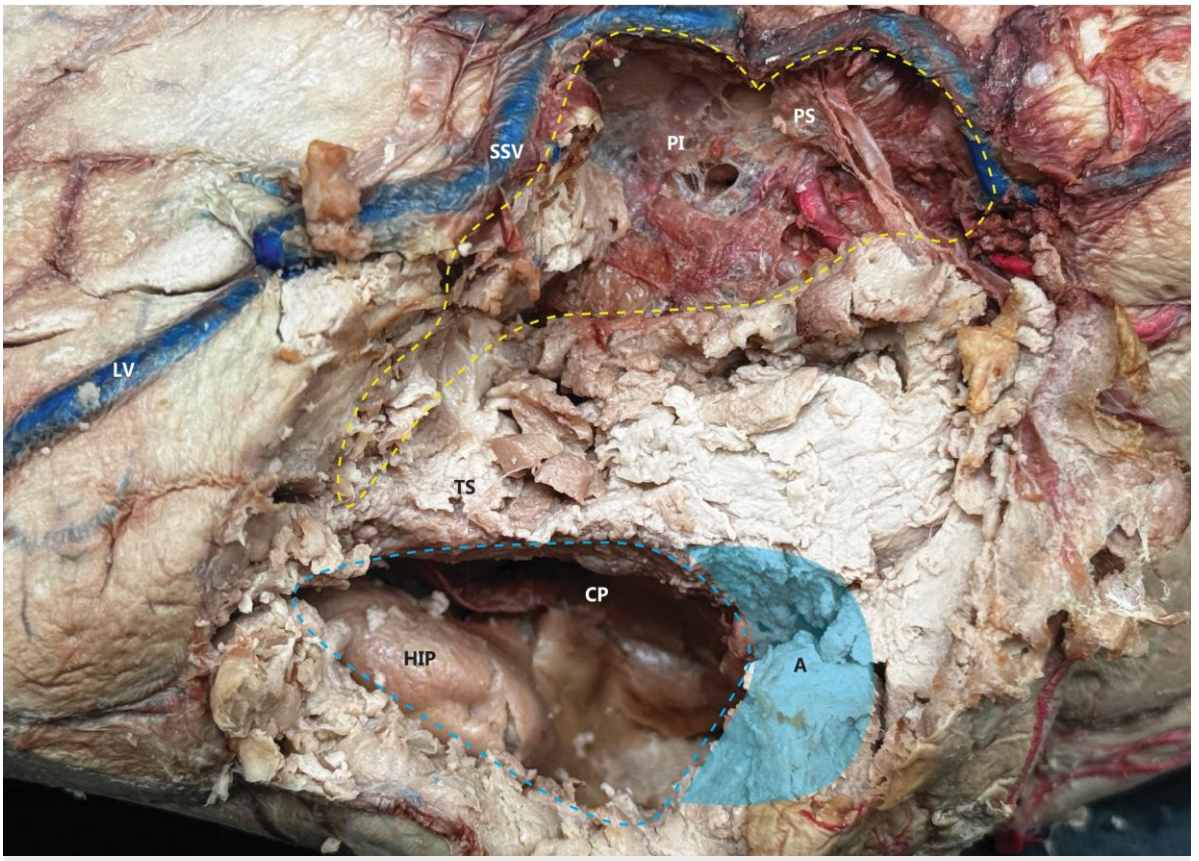
Step II: A cut measured from temp pole parallel to middle temporal gyrus.



Step VI: Complete removal of mesotemporal structures, including the parahippocampus.
CP = choroid plexus



HIP = hippocampus
LV = vein of labbe
LI = limen insulae
MCA = middle cerebral artery
SV = superficial sylvian vein

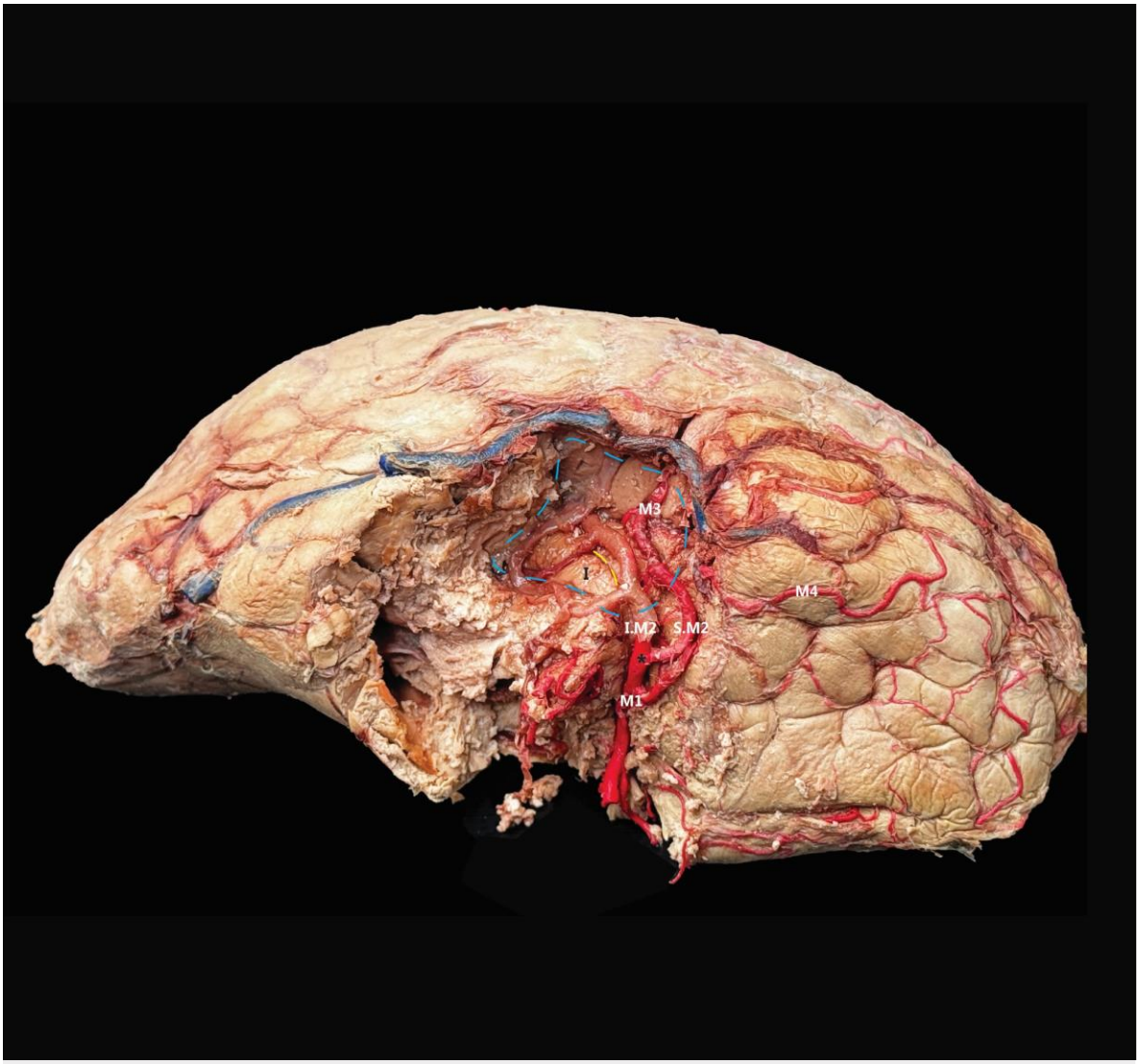


Step IV: Cortictomy was made through the medial temporal gyrus and an entry to the temporal horn was made.

LV = vein of Labbe
SSV = superficial sylvian vein
TS = temporal stem
PI = pia mater overlying the insula

PS = pia mater overlying the sphenoid compartments
yellow dashed line = superior temporal gyrus resection
blue dashed line = temporal horn

CP = choroid plexus
HIP = hippocampus
A = amygdala (deeper to the highlighted area)



| = Insula

M1 = horizontal segment of MCA

I. M2 = inferior branch of the insular segment of MCA

S. M2 = superior branch of the insular segment of MCA

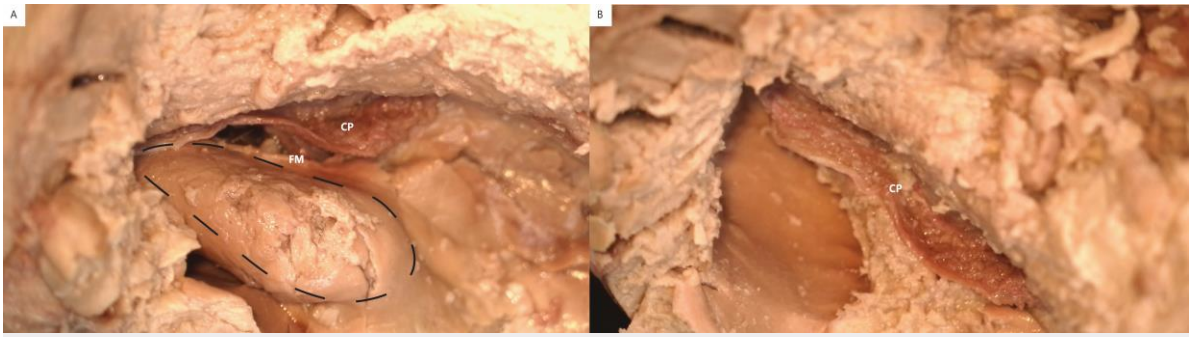
M3 = opercular segment of MCA

M4 = cortical segment

Blue dashed line = Insulo-opercular compartment of Sylvain fissure (deep)

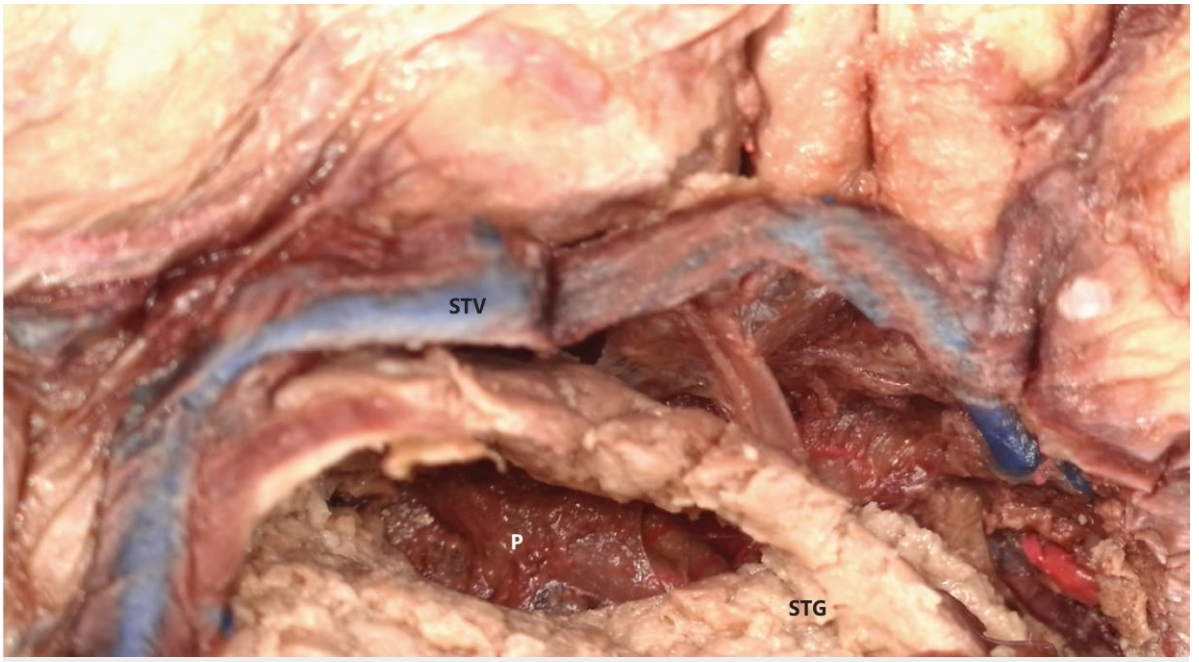
Asterisk = bifurcation point

Yellow dashed line = central insular sulcus



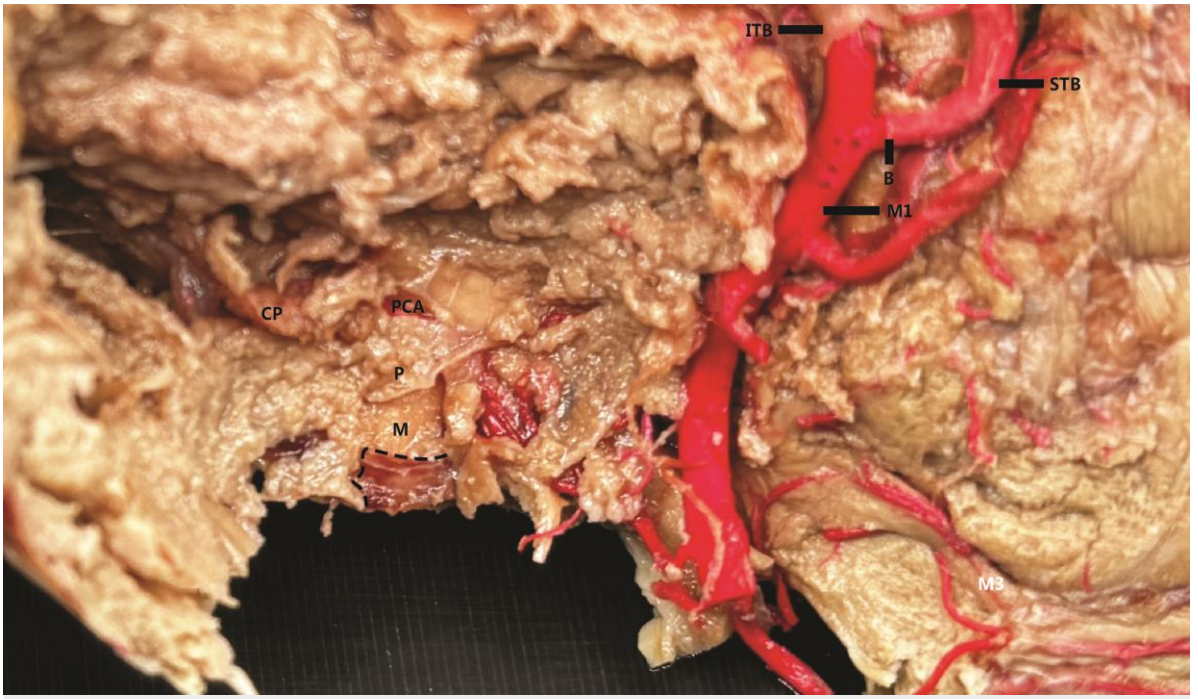
Step V: Hippocampectomy.

(A) FM = fombuia of the hippocampus
(A&B) CP = choroid plexus
(B) Post hippocampal resection



Step III: Subpial resection of superior temporal gyrus, the pia mater overlaying the insula was preserved.

P = pia matter
STG = superior temporal gyus
STV = superfiaical temporal vein



Midbrain exposed after temporal lobectomy and amygdalohippocampectomy.

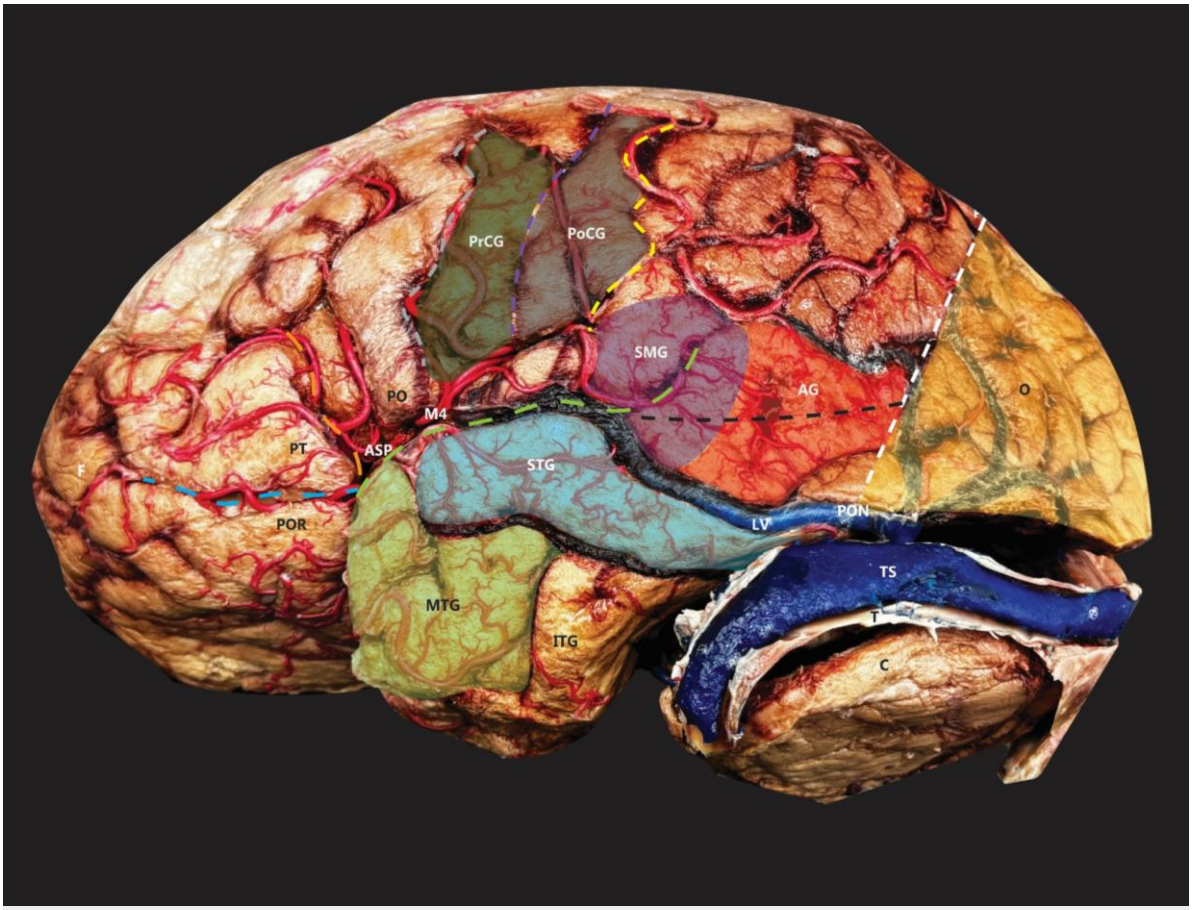
P = pia after subpial dissection over midbrain
M = midbrain
CP = choroid plexus
PCA = posterior cerebral artery

M1 = horizontal segments of middle cerebral artery (MCA)
STB = superior terminal branch of insular segment (M2) of MCA

ITB = inferior terminal branch of insular segment (M2) of MCA
B = bifurcation of MCA

LV = vein of Labbe
SSV = superficial sylvian vein
SM2 = superior trunk of MCA
IM2 = inferior trunk of MCA
I = insula

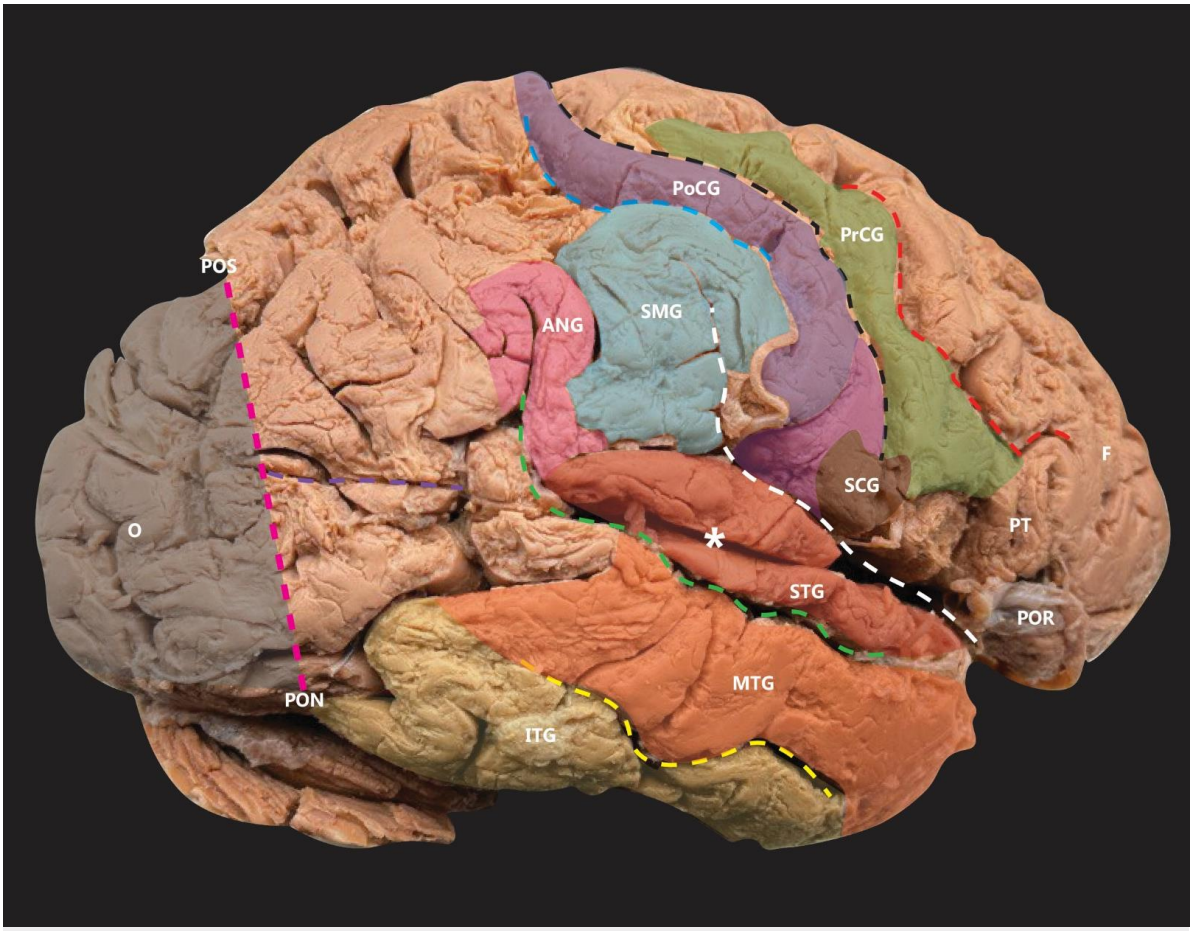
SO = superior operculum
blue dashed line = central insular sulcus
yellow dashed line = peri-insular sulcus
green dashed line = operculoinsular compartment of sylvian fissure



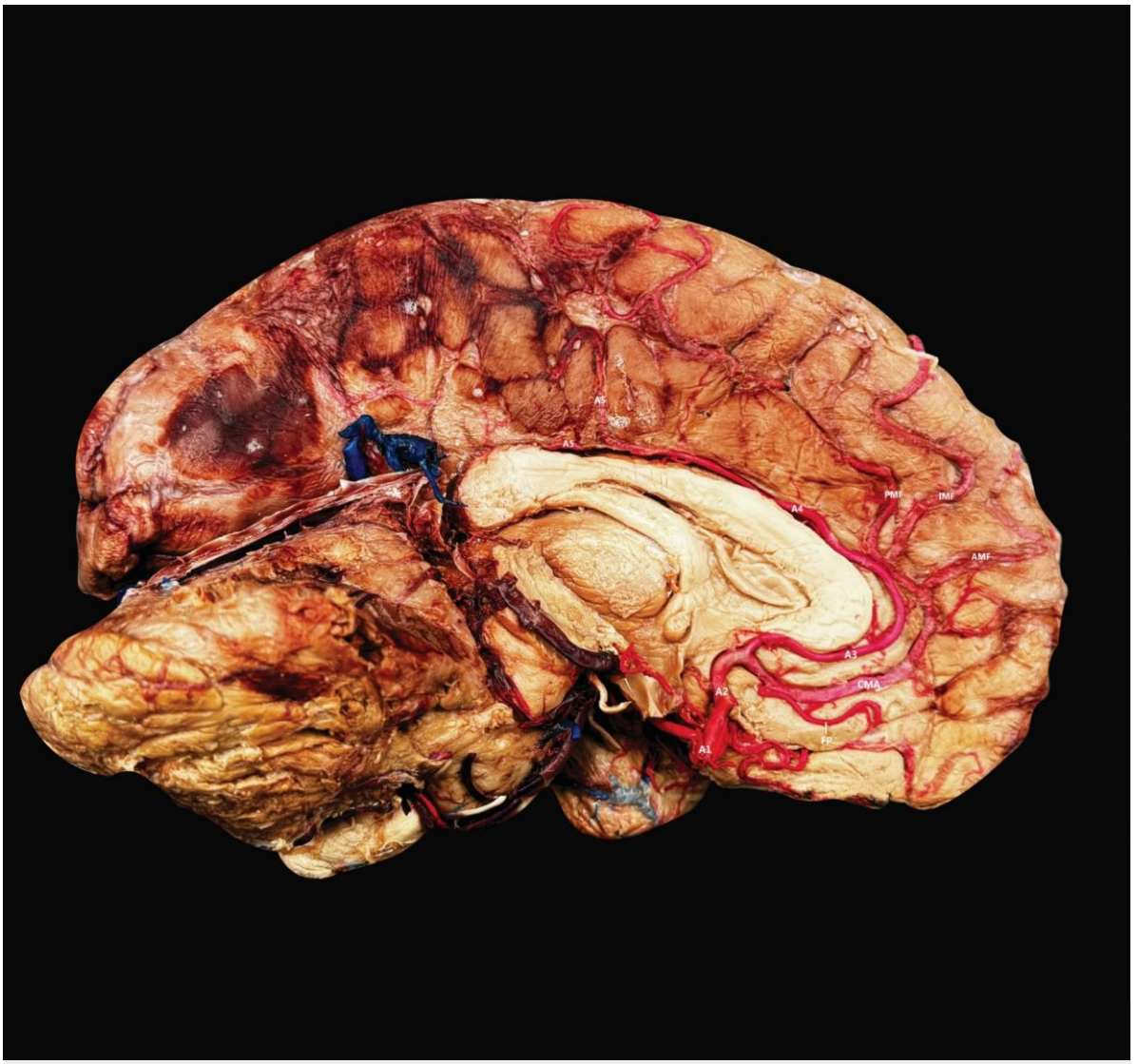
C = cerebellum
F = frontal lobe
PT = pars triangularis
POR = pars orbitalis
PO = pars opercularis
PrCG = precentral gyrus
PoCG = postcentral gyrus
SMG = supramarginal gyrus
AG = angular gyrus
POS = parieto-occipital sulcus
O = occipital lobe
PON = preoccipital notch

LV = vein of Labbe
TS = transverse sinus
STG = superior temporal gyrus
ITG = inferior temporal gyrus
MTG = middle temporal gyrus
ASP = anterior sylvian point
SV = sylvian vein
M4 = cortical segment of the middle cerebral artery
Green dashed line = sylvian fissure
Blue dashed line = horizontal ramus of sylvian fissure

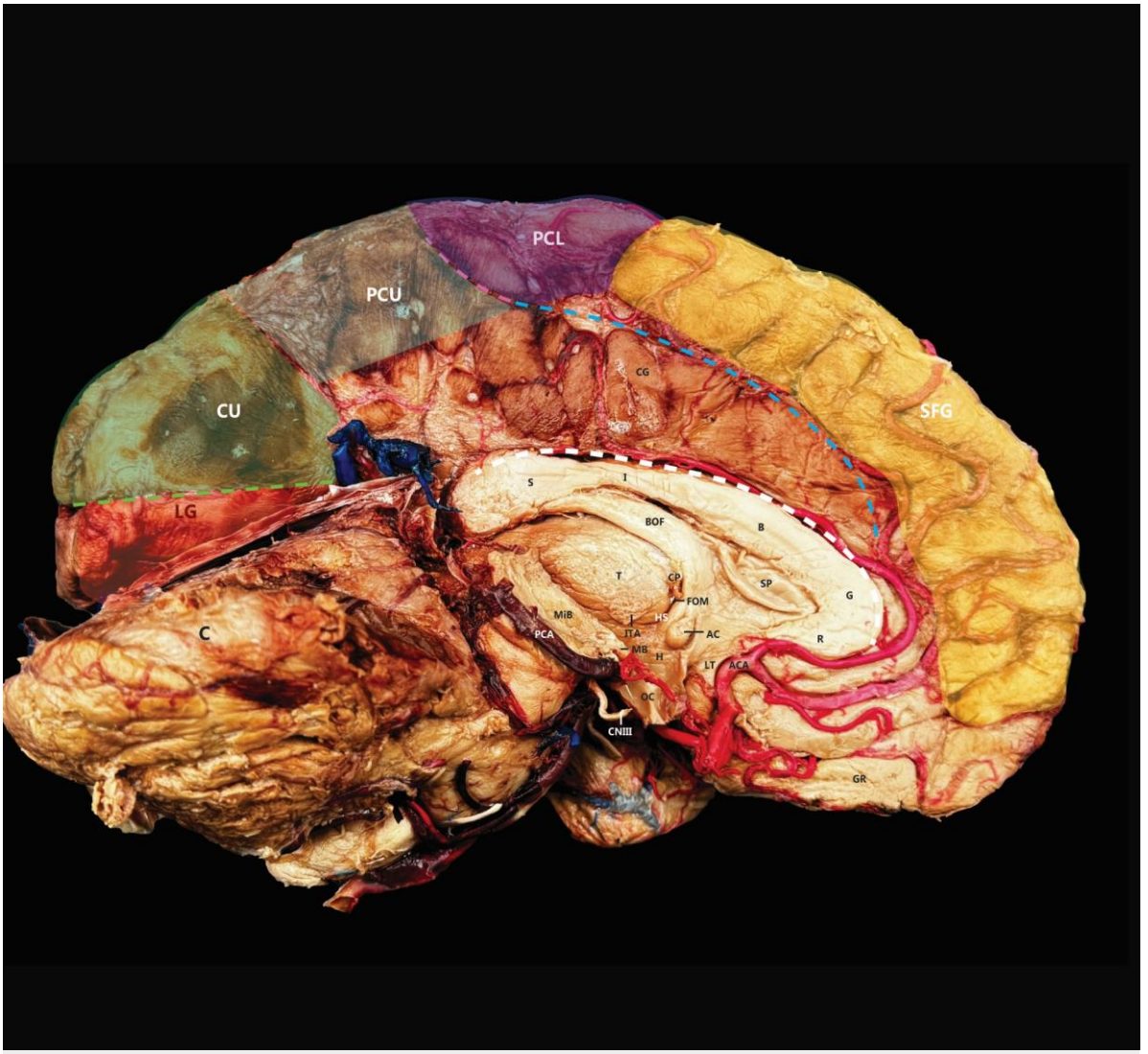
Orange dashed line = ascending ramus of sylvian fissure
Grey dashed line = precentral sulcus
Purple dashed line = central sulcus
Yellow dashed line = postcentral sulcus
White dashed line = parieto-temporal imaginary line
Black dashed line = occipitotemporal line



Black dashed line = central sulcus
white dashed line = lateral sulcus (Sylvian fissure)
red dashed line = precentral gyrus
blue dashed line = postcentral sulcus
pink dashed line = parietotemporal imaginary line
yellow dashed line = inferior temporal sulcus
green dashed line = superior temporal sulcus
purple dashed line = occipitotemporal line
ANG = angular gyrus
F = frontal lobe
O = occipital lobe
SCG = subcentral gyrus
SMG = supramarginal gyrus
MTG = medial temporal gyrus
STG = superior temporal gyrus
ITG = inferior temporal gyrus
PoCG = postcentral gyrus
PrCG = precentral gyrus
PO = pars opercularis
PT = pars triangularis
POR = pars orbitalis
PON = preoccipital notch
POS = parieto-occipital sulcus



A1 = first segment of anterior cerebral artery (precommunicating)
A2 = second segment of anterior cerebral artery (postcommunicating)
A3 = third segment of anterior cerebral artery (precallosal)
A4 = fourth segment of anterior cerebral artery (supra-callosal)
A5 = fifth segment of anterior cerebral artery (post-callosal)
CMA = callosal marginal artery
PMF = posterior middle frontal branch of callosal marginal artery
AMF = anterior middle frontal branch of callosal marginal artery
IMF = intermediate middle frontal branch of callosal marginal artery
FP = frontopolar artery
OFA = orbitofrontal artery



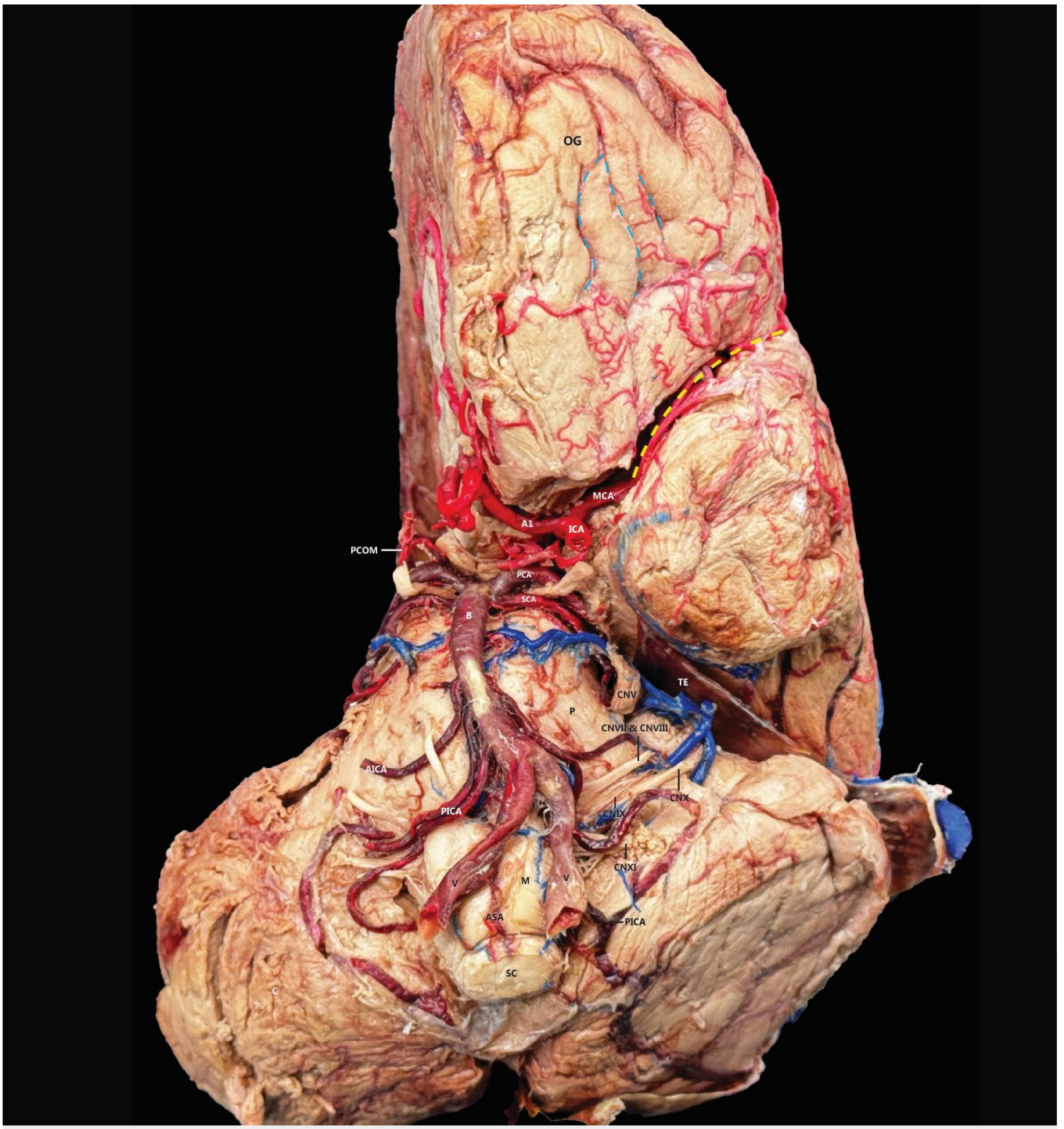
SFG = superior frontal gyrus
PCL = paracentral lobule
PCU = precuneus
CU = cuneus
LG = Lingual gyrus
CG = cingulate gyrus
S = splenium of corpus callosum
I = isthmus of corpus callosum
B = body of corpus callosum
G = genu of corpus callosum
R = rostrum of corpus callosum
T = thalamus

SP = septum pellucidum
CNIII = oculomotor nerve
MiB = midbrain
FOM = foramen of Monro
PCA = posterior cerebral artery
AC = anterior commissure
CP = choroid plexus
ITA = interthalamic adhesion
OC = optic chiasm
H = hypothalamus
MB = mammillary body
GR = gyrus rectus
LT = lamina terminalis

ACA = anterior cerebral artery
C = cerebellum
green dashed line = calcarine sulcus
blue dashed line = cingulate sulcus
pink dashed line = marginal sulcus
white dashed line = calusal sulcus

F = frontal lobe
T = temporal lobe
CNI = olfactory nerve
GR = gyrus rectus
ACA = anterior cerebral artery
OC = optic chiasm
MCA = middle cerebral artery
APS = anterior perforated substance
LOS = lateral olfactory stria
MOS = medial olfactory stria
OT = optic tract
PCOM = posterior communicating artery
B = mammillary body
B = basilar artery
P1 = first branch of the posterior cerebral artery
P2 = second branch of the posterior cerebral artery
SC = superior cerebellar artery
CNVII & CNVIII = facial and vestibulocochlear nerves
CNV = trigeminal nerve
FN = follicular nodules
C = cerebellum
P = pyramid
O = olive
D = decussation
T = tonsils
ITG = inferior temporal gyrus
OG = orbital gyri
Yellow dashed line = interhemispheric fissure
Blue dashed line = orbital sulcus
Red dashed line = sphenoidal compartments of the sylvian fissure (deep sylvian compartments)
Green dashed line = anterior fissure
White dashed line = collateral sulcus
U = uncus
CNIII = oculomotor nerve
Orange dashed line = olfactory sulcus
FG = fusiform gyrus
AICA = anterior inferior cerebellar artery
Pink dashed line = occipito-temporal sulcus
Purple dashed line = ventro-lateral sulcus

SFG = superior frontal gyrus
PCL = paracentral lobule
CU = cuneus
LG = lingual gyrus
CG = cingulate gyrus
§ = splenium of corpus callosum
1 = isthmus of corpus callosum
B = body of corpus callosum
G = genu of corpus callosum
R = rostrum of corpus callosum
MiB = midbrain
TH = thalamus
P = pons
MO = medulla oblongata
CP = cingulate pole
PaOG = paraolfactory gyrus
GR = gyrus rectus
LV = lateral ventricle
T = tentorium
VOG = vein of Galen
FC = folia of cerebellum
4V = fourth ventricle
AQ = aqueduct of Sylvius
green dashed line = cingulate sulcus
white dashed line = callosal sulcus
orange dashed line = parieto-occipital sulcus
blue dashed line = calcarine sulcus
black dashed line = central sulcus
yellow dashed line = marginal sulcus
pink dashed line = subparietal sulcus
red dashed line = posterior occipital sulcus



OG = orbital gyri
MCA = middle cerebral artery
ICA = internal carotid artery
A1 = horizontal segment of the anterior cerebral artery
PCA = posterior cerebral artery
SCA = superior cerebellar artery
B = basilar artery
P = pons
M = medulla oblongata
AICA = anterior inferior cerebellar artery
PICA = posterior inferior cerebellar artery
V = vertebral arteries
ASA = anterior spinal artery
CNIX = glossopharyngeal nerve
CNX = vagus nerve
CNV = trigeminal nerve
CNVII & CNVIII = facial and vestibulocochlear complex
CNXI = accessory nerve
C = cerebellum
SC = spinal cord (cervicomedullary junction)
TE = tentorium
PCOM = posterior communicating artery
blue dashed line = orbital sulcus
yellow dashed line = sphenoidal compartments of the sphenoidal fissure (deep part)

3dV = third ventricle
LT = lamina terminals

SFG = superior frontal gyrus
PCL = paracentral lobule
PCU = precunus
CU = cuneus
LG = lingual gyrus
CG = cingulate gyrus
S = splenium of corpus callosum
I = isthmus of corpus callosum
B = body of corpus callosum
G = genu of corpus callosum
R = rostrum of corpus callosum
MiB = midbrain
H = hypothalamus
GR = gyrus rectus
LV = lateral ventricle
CO = column of fornix
BOF = body of fornix
TP = temporal pole
ITG = inferior temporal gyrus
FFG = fusiform gyrus
LG = lingual gyrus
CP = cingulate pole
HIP = hippocampus
U = uncus
PG = parahippocampal gyrus
Dark blue dashed line = precentral gyrus
sky blue dashed line = central sulcus
Pink dashed line = marginal sulcus
White dashed line = cingulate sulcus
Black dashed line = callosal sulcus
Yellow dashed line = posterior occipital sulcus
Green dashed line = calcarine sulcus
Red dashed line = collateral sulcus
Light pink dashed line = occipital temporal sulcus
MCA = middle cerebral artery
A2 = second segment of anterior cerebral artery (postcommunicating)
A3 = third segment of anterior cerebral artery (precallosal)
A4 = fourth segment of anterior cerebral artery (supra-callosal)
A5 = fifth segment of anterior cerebral artery (post-callosal)
CMA = callosal marginal artery

M = medulla
CT = cerebellar tonsils
V = vermis
ISC = inferior surface of cerebellum

SO = suboccipital surface of the cerebellum
ST = superior surface (tentorial) of the cerebellum

SO = suboccipital surface of the cerebellum
M = medulla

CT = cerebellar tonsils
V = vermis

CV = cerebellar vein

ICV = internal cerebral vein
3dV = third ventricle
SC = superior colliculus
IC = inferior colliculus
SCS = supracollicular sulci
F = frenulum veli
IBT = inferior brachial triangle
CNIV = trochlear nerve
C = cerebellum

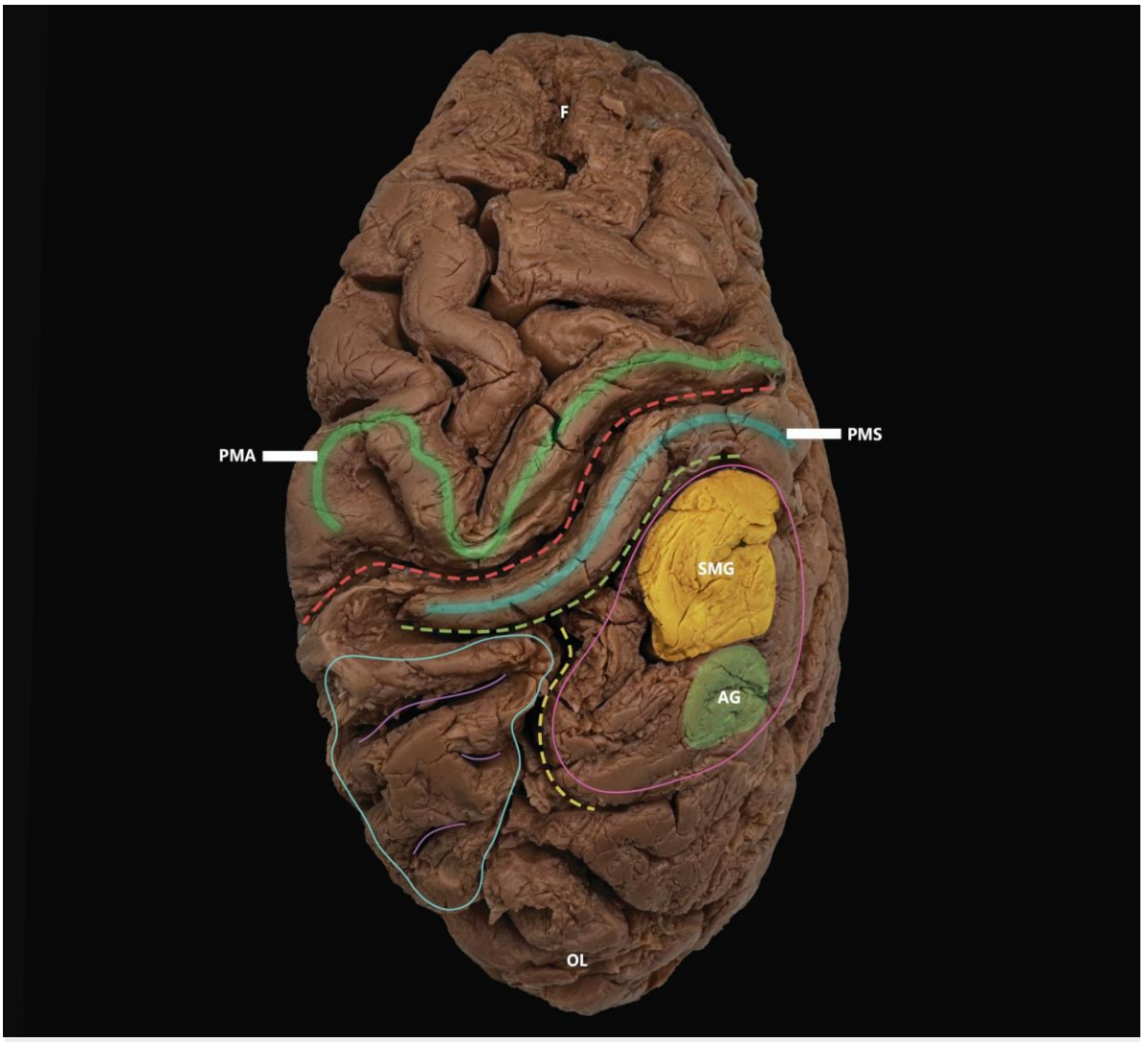
P3dV = posterior third ventricle
PG = pineal gland
SC = superior colliculus
IC = inferior colliculus
V = vermis
SSC = superior surface of cerebellum

V = vermis
U = uvula
CT = cerebellar tonsils

IMV = inferior medullary velum
TC = tela choroidea
4thV = fourth ventricle

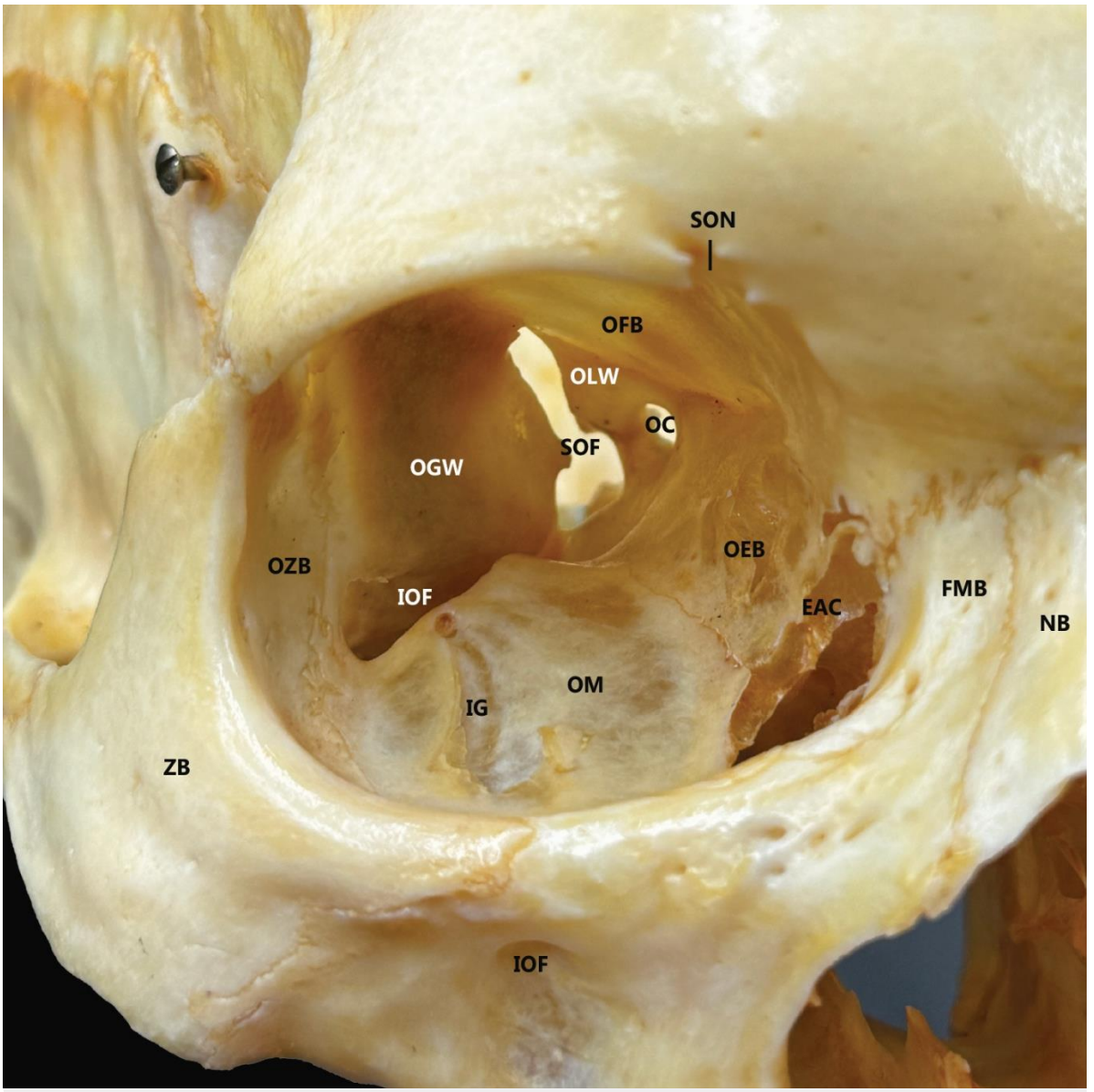
M = medulla oblongata
PICA = posterior inferior cerebellar artery

SO = suboccipital surface
V = vermis
CT = cerebellar tonsils
CMF = cerebellar medullary fissure
PICA = posterior inferior cerebellar artery



Superior projection.

F = frontal lobe
OL = occipital lobe
PMA = precentral gyrus
PMS = postcentral gyrus
SMG = supramarginal gyrus
AG = angular gyrus
Red dashed line = central sulcus
Green dashed line = postcentral sulcus
Yellow dashed line = intraparietal sulcus
Pink line = inferior parietal lobule
Blue line = superior parietal lobule
Purple line = sulci within superior parietal lobule



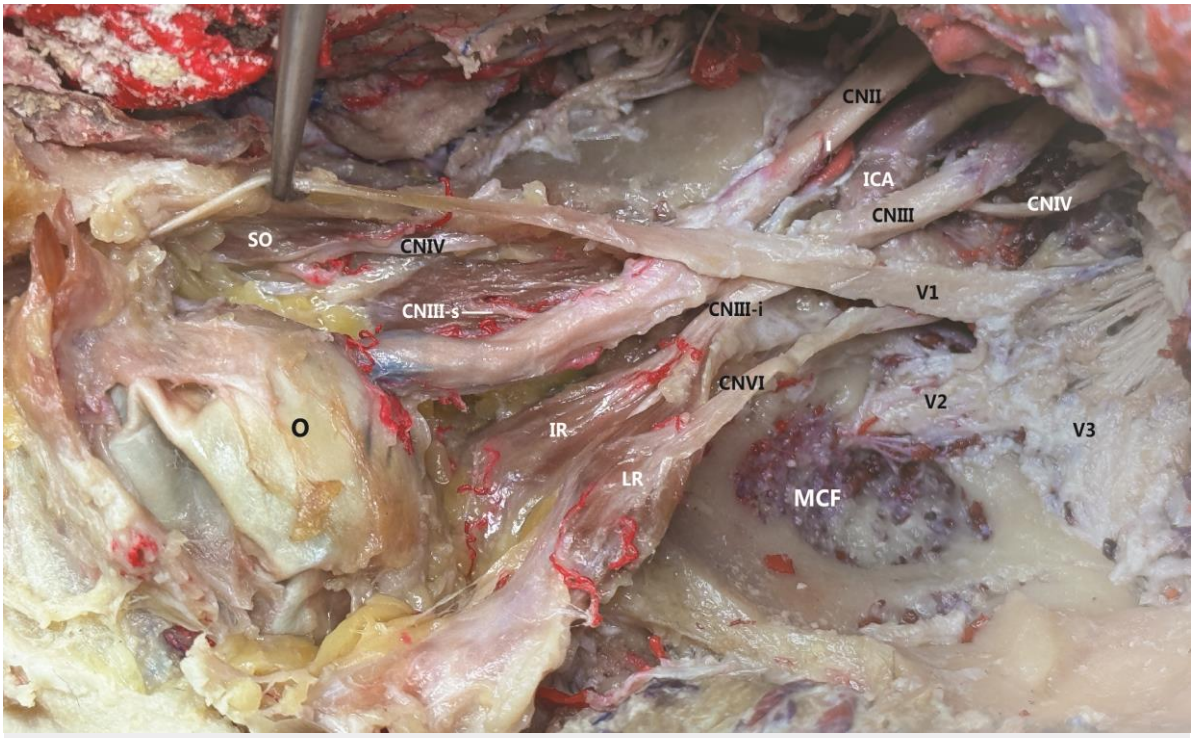
OFB = orbital surface of frontal bone
OLW = orbital surface of lesser wing of sphenoid bone
SOF = superior orbital fissure
OC = optic canal
OGW = orbital surface of greater wing of sphenoid bone
OZB = orbital surface of zygomatic bone
IOF = inferior orbital fissure
IG = infraorbital groove
SON = supraorbital notch
OEB = orbital plate of ethmoid bone
OM = orbital surface of maxilla
IOF = infraorbital foramen
EAC = ethmoid air cell

IF = incisive fossa
IMS = intramaxillary suture
PPPM = palatine process of maxilla
ZP = zygomatic process
PNA = posterior nasal aperture (choana)
black dashed line = palatomaxillary suture
C = choanae
HPPB = horizontal plate of palatine bone
LPF = lesser palatine process
PPPB = pyramidal process of palatine bone
AOV = ala of vomer
V = vomer
ZB = zygomatic bone
ZP = zygomatic process
PF = pterygoid fossa
GW = greater wing
GOA = groove of auditory tube
LPF = lesser palatine foramina
GPF = greater palatine foramen
PH = pterygoid hamulus
MPP = medial plate
LPP = lateral plate
PF = pterygoid fossa
MF = mandibular fossa
FM = foramen magnum
JFO = jugular fossa
JF = jugular foramen
green dashed line = petrotympanic fissure
CC = carotid canal
HC = hypoglossal canal
OC = occipital condyle
black asterisk = inferior tympanic canaliculus
pink asterisk = mastoid canaliculus
purple line = mastoid notch
PT = pharyngeal tubercle
OAG = occipital artery groove
COC = condylar canal
BP = basilar part
CF = condylar fossa
SNL = superior nuchal line
EOP = external occipital protuberance
INL = inferior nuchal line
EOC = external occipital crest
MN = mastoid notch
EAM = external acoustic meatus
SP = styloid process
SMF = stylomastoid foramen
MP = mastoid process
SF = scaphoid fossa
LPP = lateral pterygoid plate
FL = foramen lacerum
FS = foramen spinosum
FO = foramen ovale
AT = articular tubercle
S = spine of sphenoid bone
APPB = apex of petrous part of temporal bone

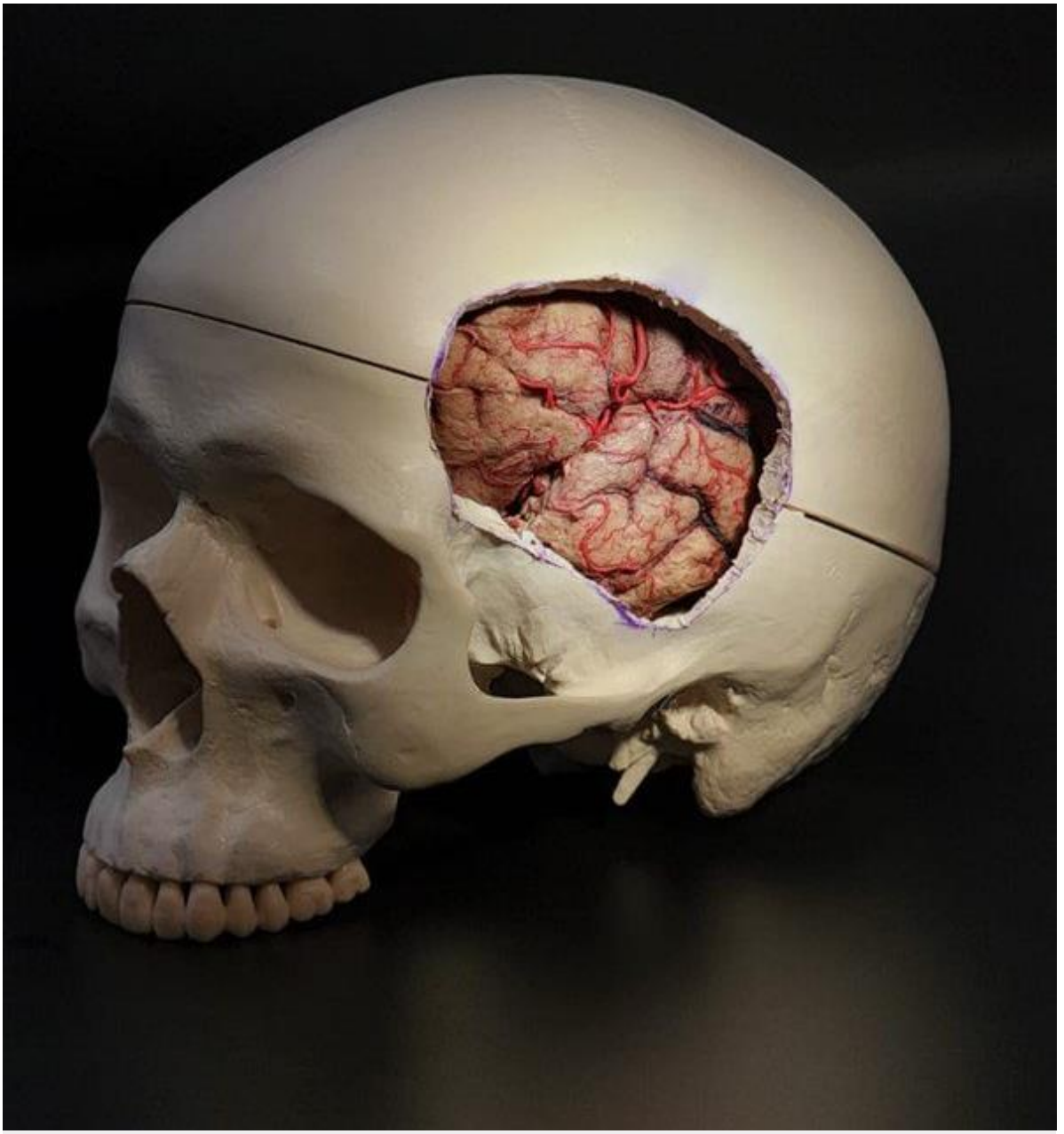
SB = sphenoid bone
FB = frontal bone
SON = supraorbital notch
G = glabella
OP = orbital plate
FLS = fossa for lacrimal sac
NB = nasal bone
M = maxilla
ANS = anterior nasal spine
AP = alveolar process
ZB = zygomatic bone
ZFF = zygomaticofacial foramen
ZA = zygomatic arch
PB = parietal bone
TF = temporal bone
Blue dashed line = coronal suture
Black dashed circle = pterion

SP = squamous part of temporal bone
ZP = zygomatic process
AT = articular tubercle
SMC = supramastoid crest
EAM = bony external acoustic meatus
MP = mastoid process
Black dashed line = lambdoid suture
OB = occipital bone
W = sutural bone (Wormian)
EOP = external occipital protuberance
A = asterion
M = mandible
MC = mandibular condyle

MN = mandibular notch
CP = coronoid process
R = ramus
OL = oblique line
B = body
MF = mental foramen
Orange dashed line = occipitomastoid suture
Purple dashed line = parietomastoid suture
Green dashed line = sphenofrontal suture
Brown dashed line = frontozygomatic suture
Black dashed triangle = suprameatal triangle
MET = mental protuberance



CNII = optic nerve
ICA = internal carotid artery
CNIII = oculomotor nerve
V1 = ophthalmic branch of the trigeminal nerve
V2 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
CNIV = trochlear nerve
CNVI = abducens nerve
CNIII-i = inferior division of the oculomotor nerve
CNIII-S = superior division of the oculomotor nerve
MR = medial rectus muscle
LR = lateral rectus muscle
IR = inferior rectus muscle
MCF = middle cranial fossa
SO = superior oblique muscle
O = orbit

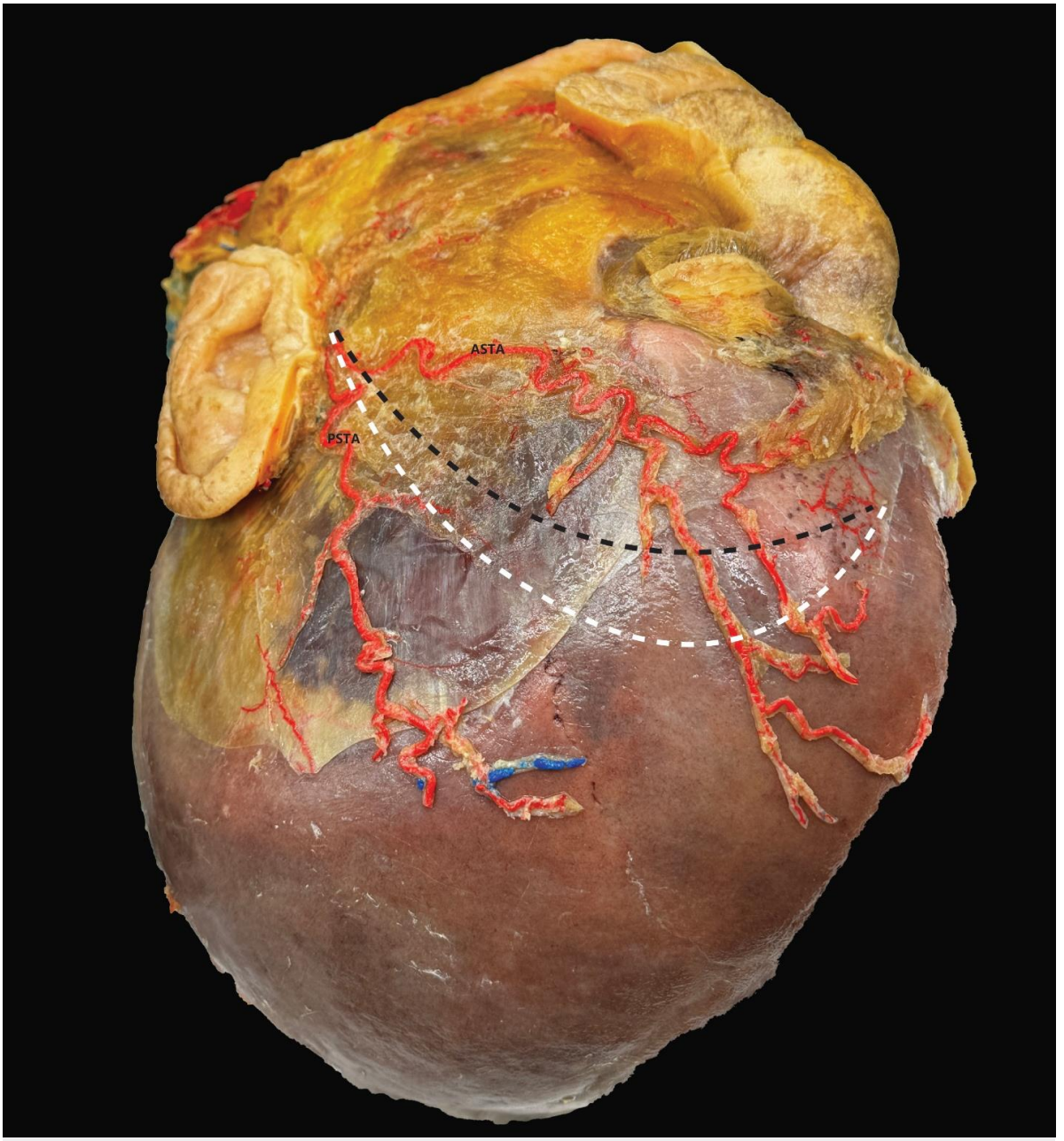


Pterional craniotomy exposure

Head is rotated 15-20 degrees (variable) degrees to the contralateral side, elevated and slightly extended with lateral neck extension so that the zygoma is the highest point.

Pterional skin incision (variations)

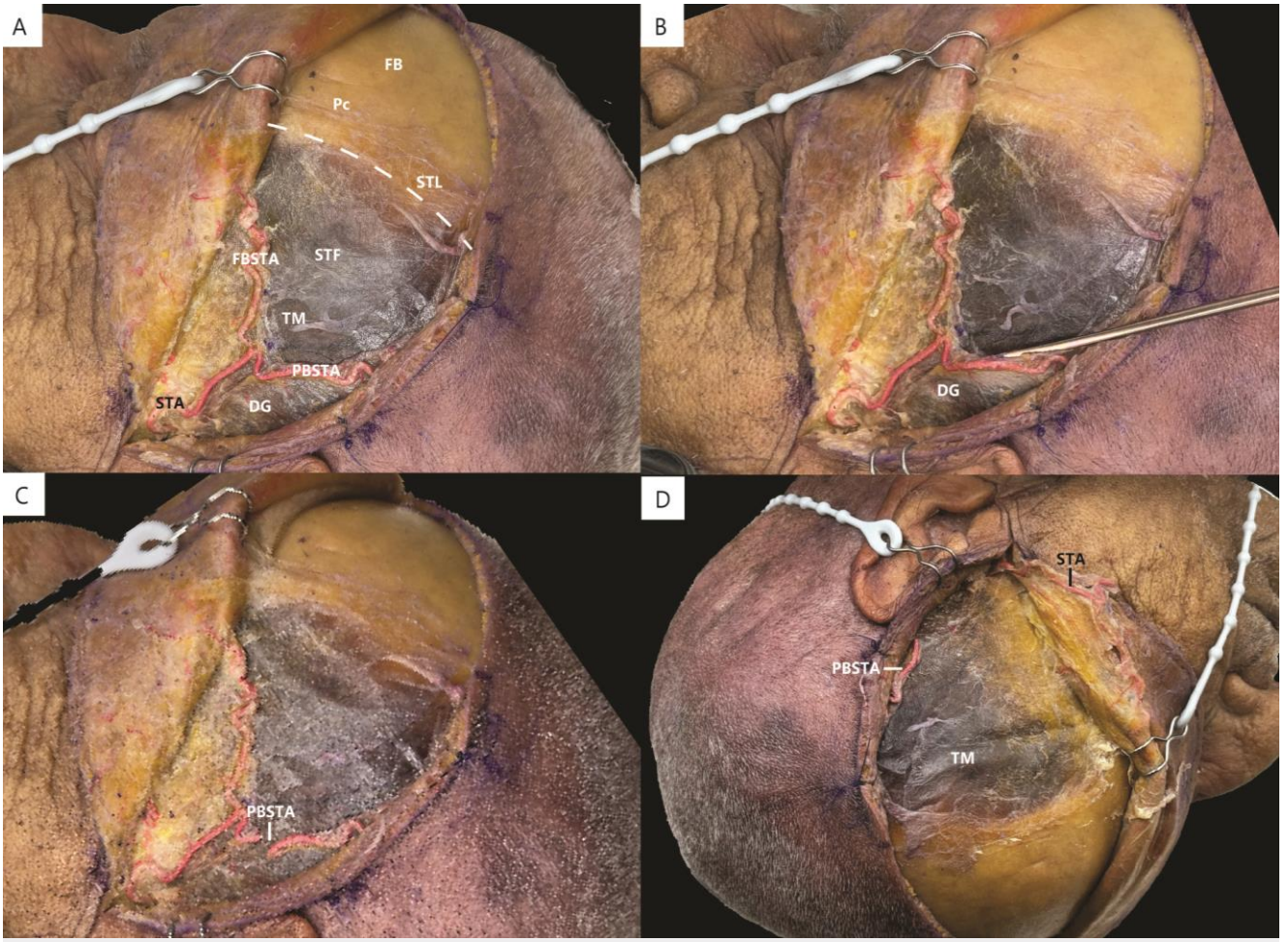
Starting less than one 1 cm from the tragus, crossing the temporal region to the superior temporal line, it then curves anteriomedialy and ends at the midline behind the hair line.



Demonstration of the skin incision variations in relation to the STA. Pterional incision (variations). The typical incision starts less than one 1 cm from the tragus, crosses the temporal region to the superior temporal line, it then curves anteromedially and ends at the midline behind the hair line.

ASTA = anterior branch of the superficial temporal artery

PASTA = parietal branch of the superficial temporal artery



Dissection and preservation of the superficial temporal artery

A- Exposure of the superficial temporal artery frontal and posterior branches. .

B- Exposure of the deep gelea containing superifical temporal artery

C- Cutting the parietal branch of the superficial temporal artery.

D- The superficial temporal artery was reflected anterior with the skin after it is being released from its posterior (Parietal branch)

FB = frontal bone
PBSTA = parietal branch of superficial temporal artery
STA = superficial temporal artery
STF = superficial temporal fascia
STL = superior temporal line
Pc = pericranium
TM = temporalis muscle
FBSTA = frontal branch of superficial temporal artery
DG = deep galea
PBSTA = parietal branch of superficial temporal artery

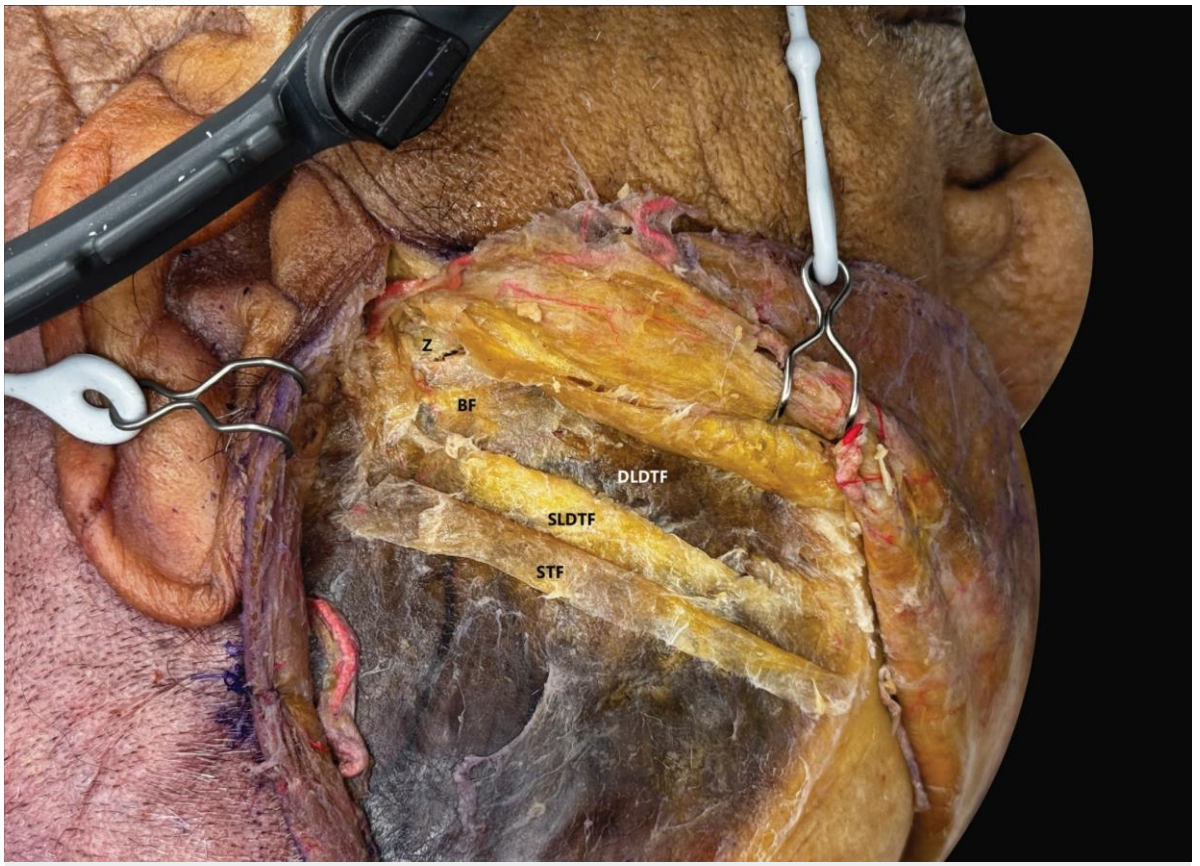
Demonstration of an interfacial dissection.

1. Identification of the temporal fat pad 1-2 cm superior to the zygomatic arch

2. An incision through the superficial temporal facia was made parallel to the zygomatic arch and directed posterior to anterior

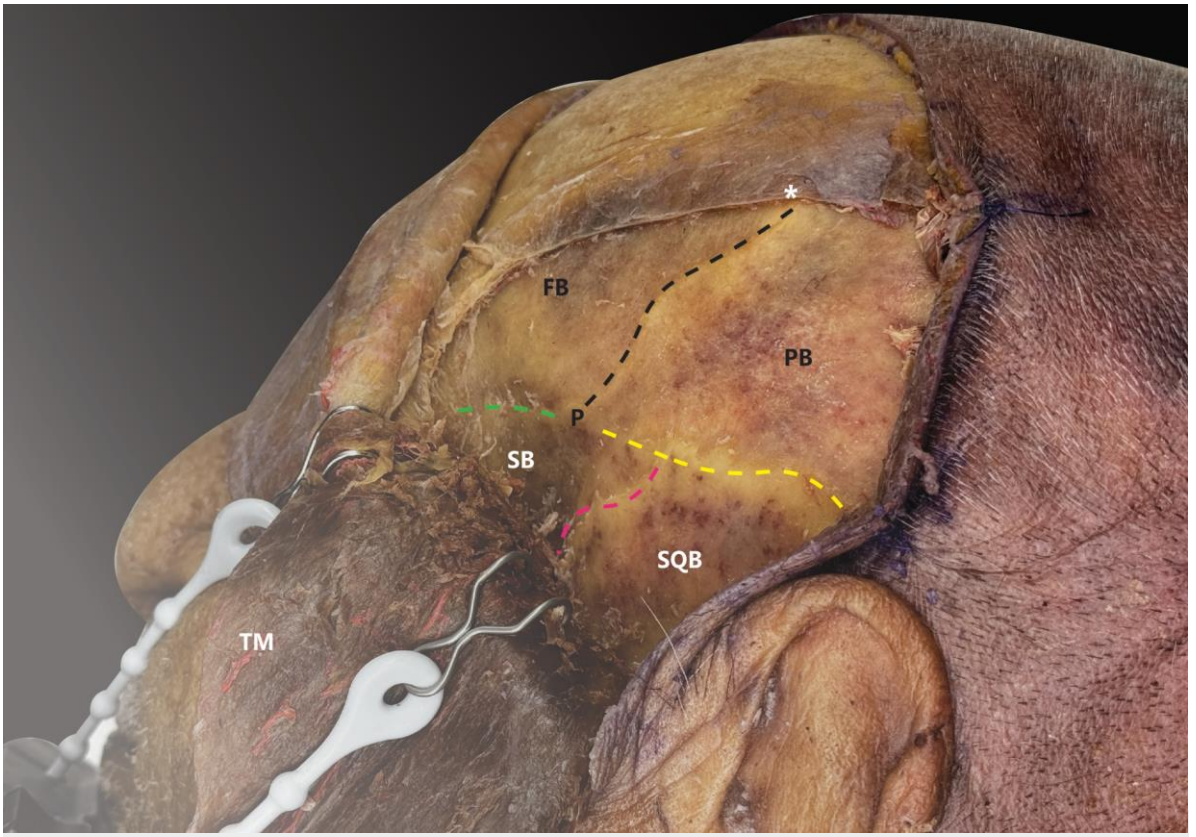
3. the temporal fat pad was reflected anteriorly over the zygomatic arch.

SLDTF = superficial layer of deep temporal fascia
DLDTF = deep layer of deep temporal fascia
BF = buccal fat
STF = superficial temporal fascia
ZPFB = zygomatic process of frontal bone
PBSTA = parietal branch of superficial temporal artery
TFP = temporal fat pad



Anatomical demonstration of the temporal fascia layers and an interfacial dissection.

SLDTF = superficial layer of deep temporal fascia
DLDTF = deep layer of deep temporal fascia
BF = buccal fat
STF = superficial temporal fascia
Z = zygoma



Temporalis muscle is detached starting form the zygomatic process anteriorly and over the superior temporal line, leaving a cuff over the superior temporal line (Asterisk).

TM = temporalis muscle
SB = sphenoidal bone
FB = frontal bone
Black dashed line = coronal suture
St = stephanion
Yellow dashed line = squamoparietal suture
PB = parietal bone
Pink dashed line = squamous suture
SQB = squamosal part of the temporal bone
P = pterion

A standard pterional craniotomy (3 burr holes).

1. Keyhole superior to the frontozygomatic suture, above the anterior portion of the superior temporal line.

2. Second burr hole, over the posterior portion of the superior temporal line.

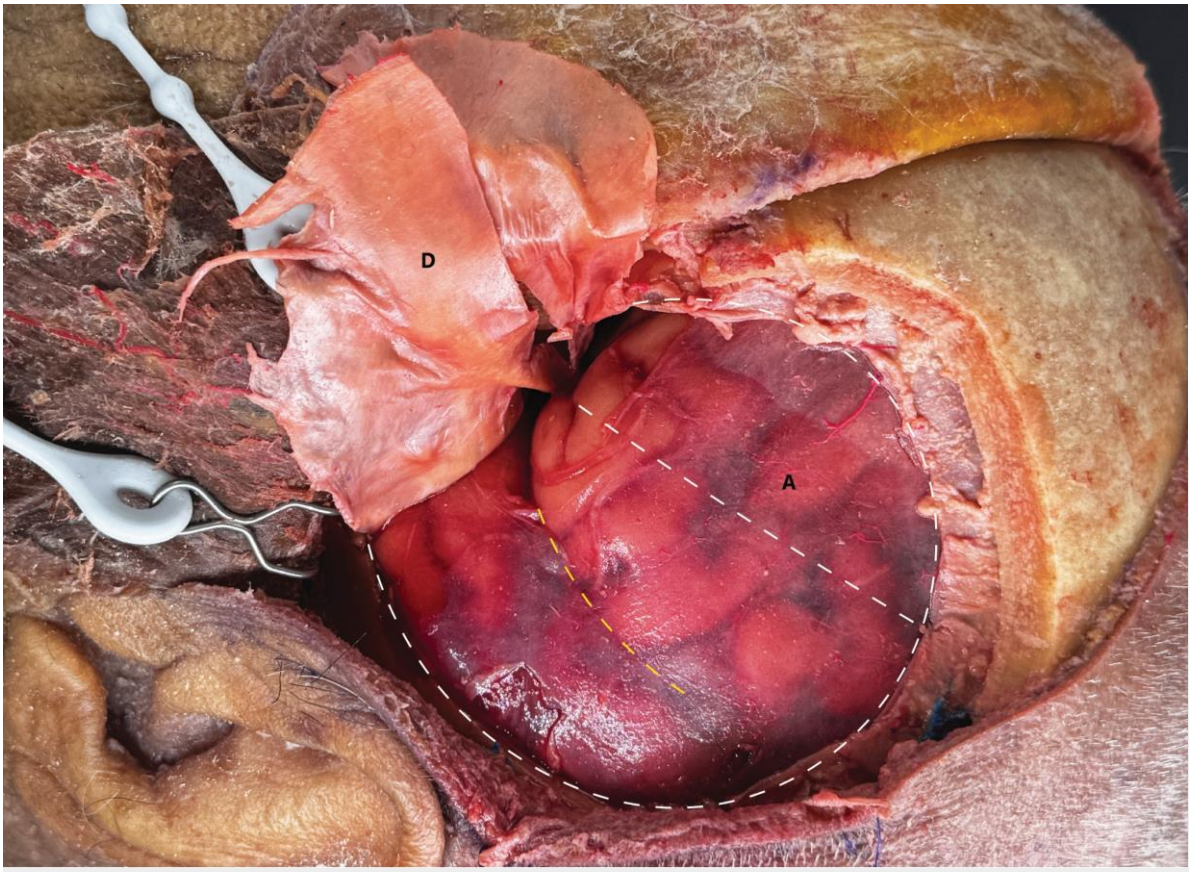
3. Third burr hole over the squamousal part of the temporal bone.

K= keyhole
H2 = second burr hole
H3 = third burr hole

MMA = middle meningeal artery
PMMA = parietal branch of middle meningeal artery
FMMA = frontal branch of middle meningeal artery
DM = dura mater

Drilling of the sphenoid wing and expouser of the meningeal-orbital band

MCF = middle cranial fossa
MOB = meningeal-orbital band
SW = sphenoid wing
ACF = anterior cranial fossa

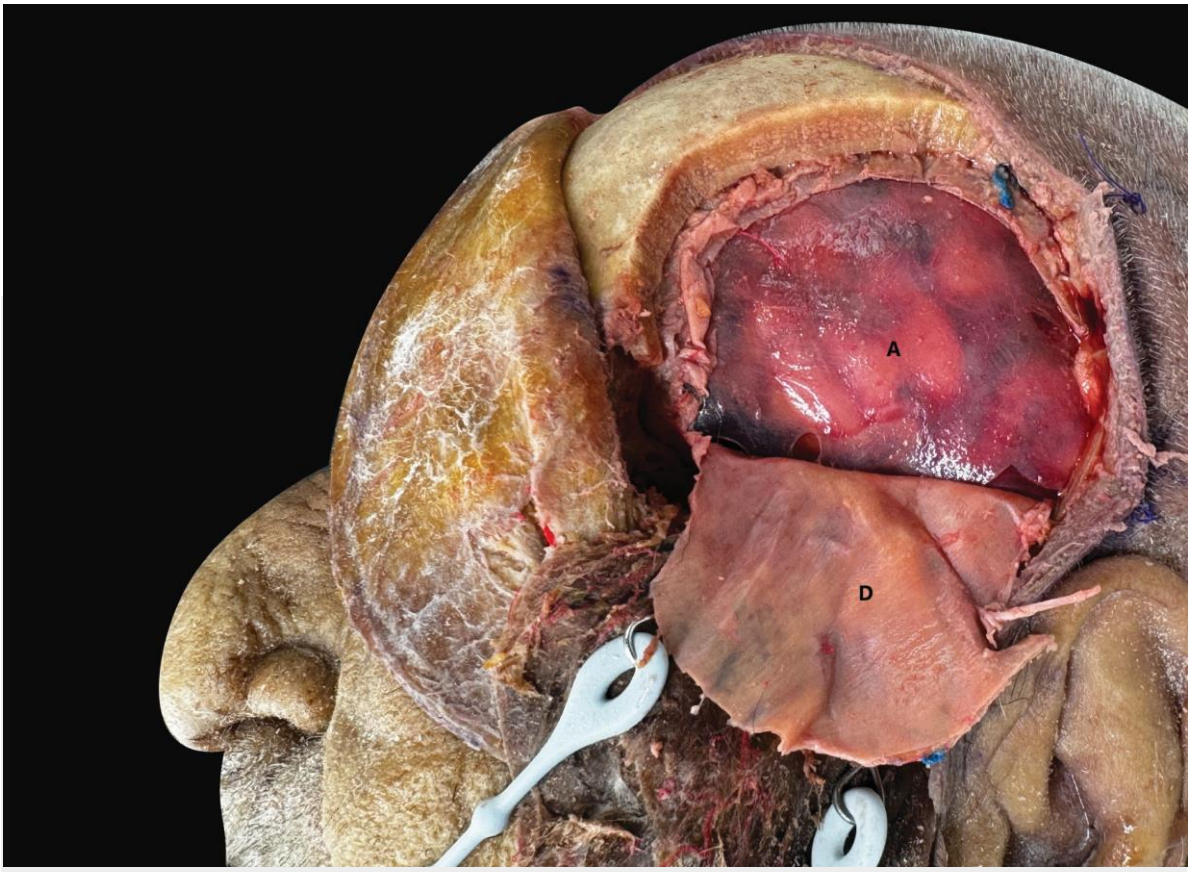


Dural incision

Demonstration of the curvilineal incision of the dura with an additional cut from the frontal burr hole to the lesser wing of the sphenoid, leaving two leaflets of the dura.

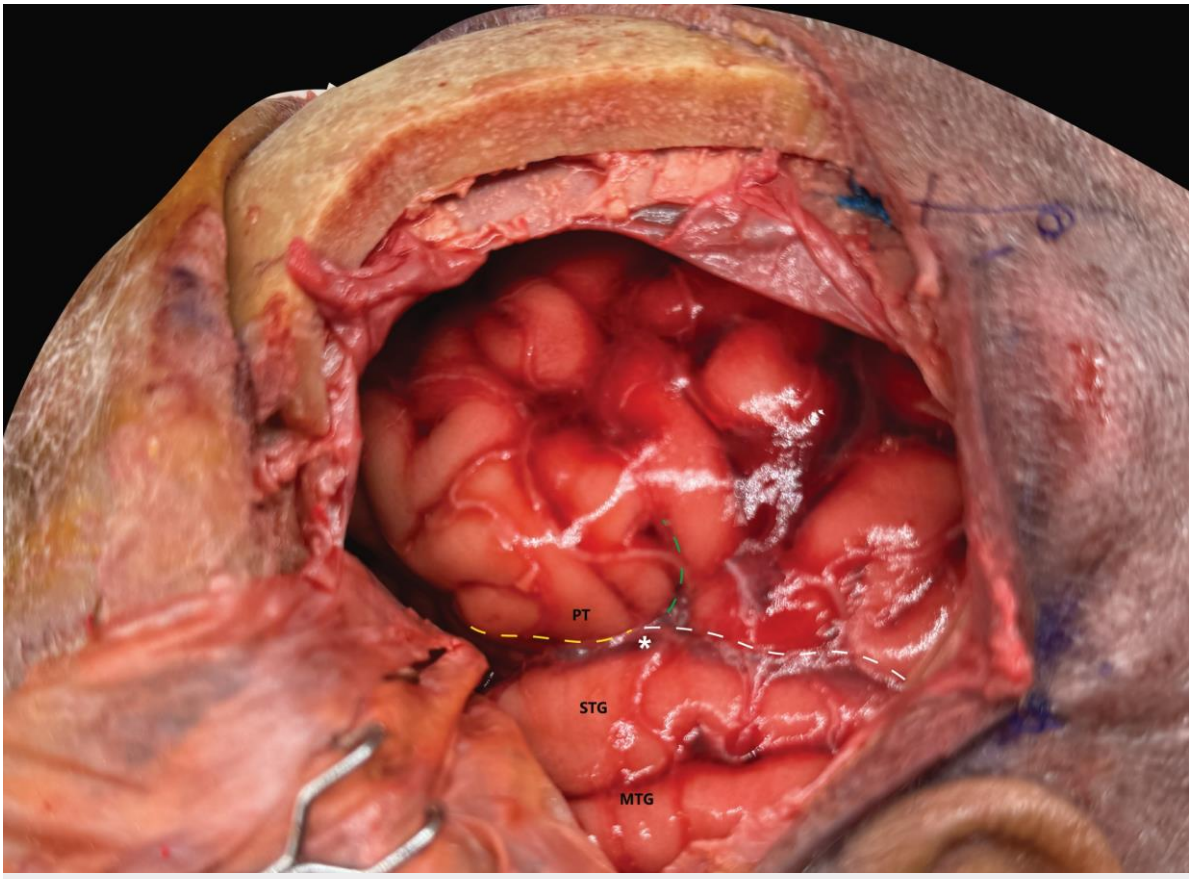
D = dura matter
A = arachnoid matter

yellow dashed line = sylvian fissure
white dashed line = the dural incision



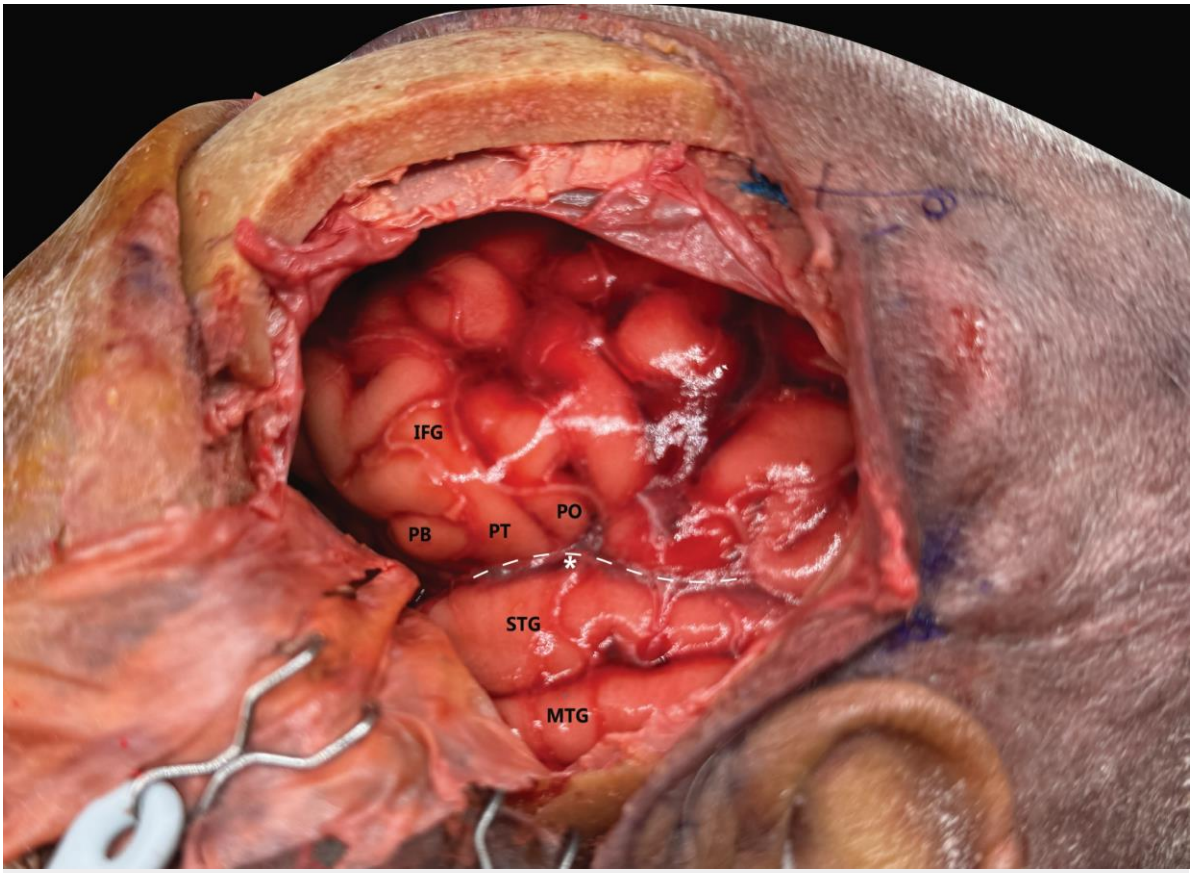
D = dura matter

A = arachnoid matter



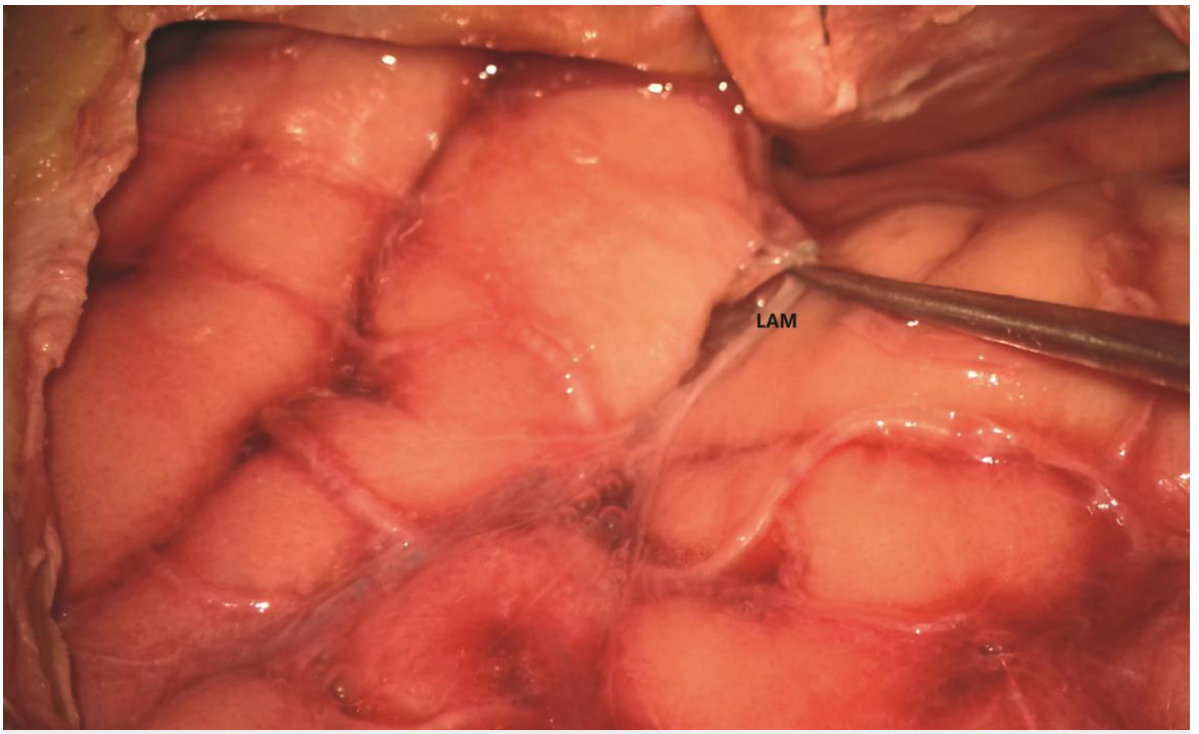
The superficial compartment of the sylvian fissure. Noted the horizontal ramus, the stem, the ascending ramus of the Sylvain fissure and the posterior ramus of the Sylvain fissure.

PT = pars triangularis
STG = superior temporal gyrus
MTG = middle temporal gyrus
White dashed line = The posterior ramus of the Sylvian fissure
Asterisk = anterior sylvian point
Green dashed line = ascending ramus of the Sylvain fissure
Yellow dashed line = Horizontal ramus of the Sylvian fissure

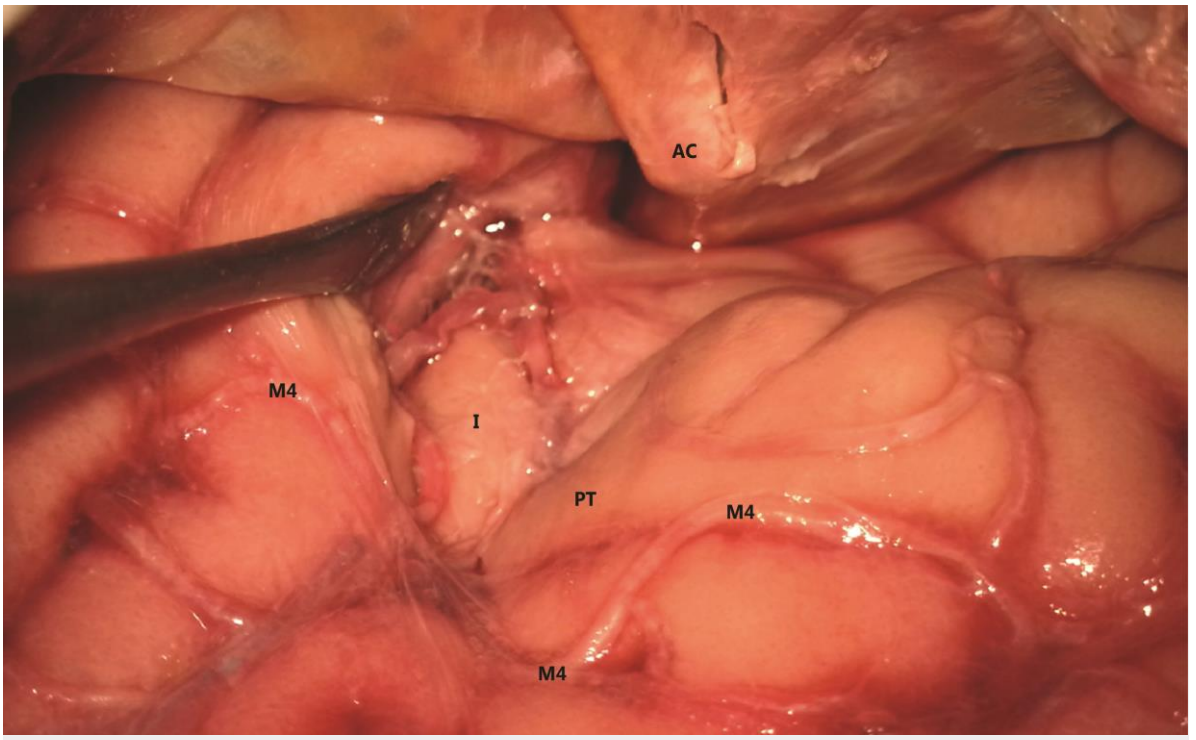


Intradural exposure of the pterional approach

PB = pars orbitalis
PT = pars triangularis
PO = pars opercularis
STG = superior temporal gyrus
MTG = middle temporal gyrus
IFG = inferior temporal gyrus
white dashed line = lateral membrane of the sylvian fissure
asterisk = anterior sylvian point



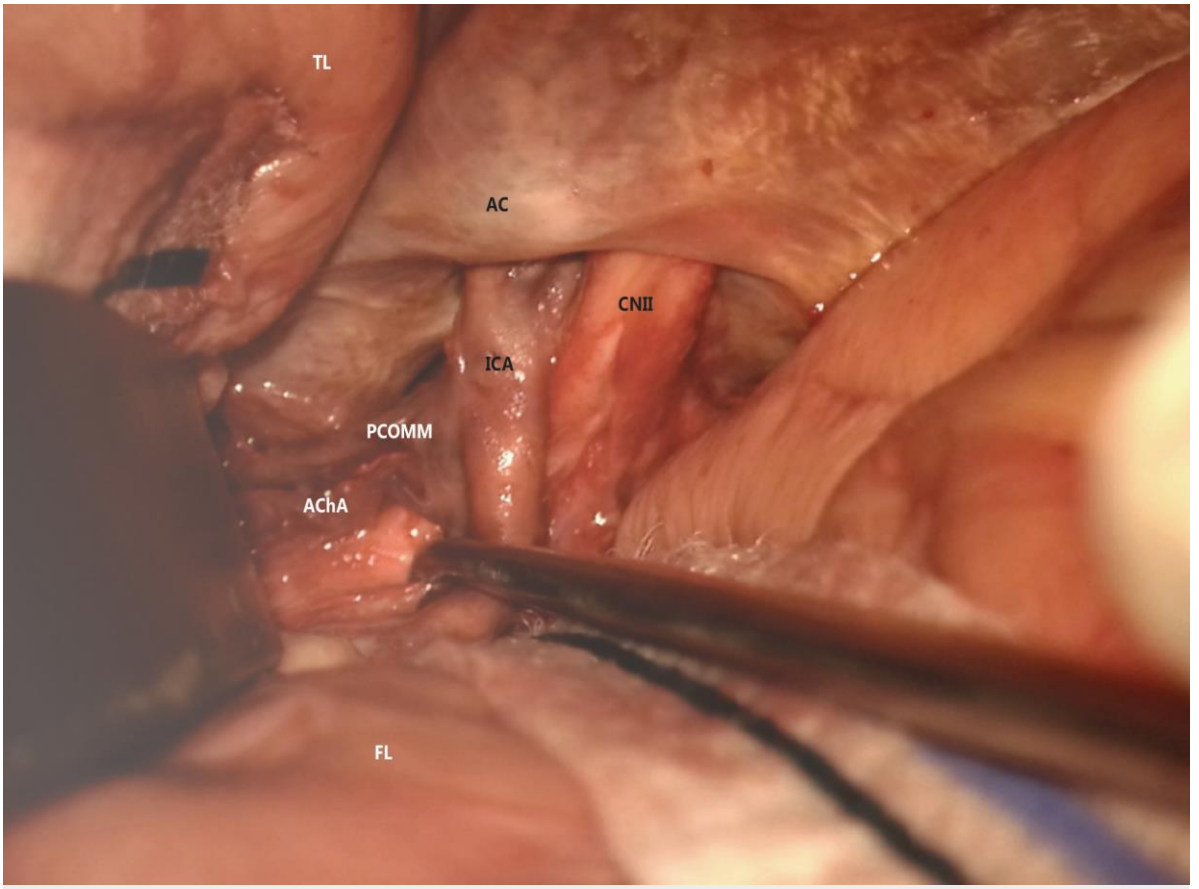
LAM = lateral arachnoid membrane, overlying the superficial compartment of the Sylvain fissure



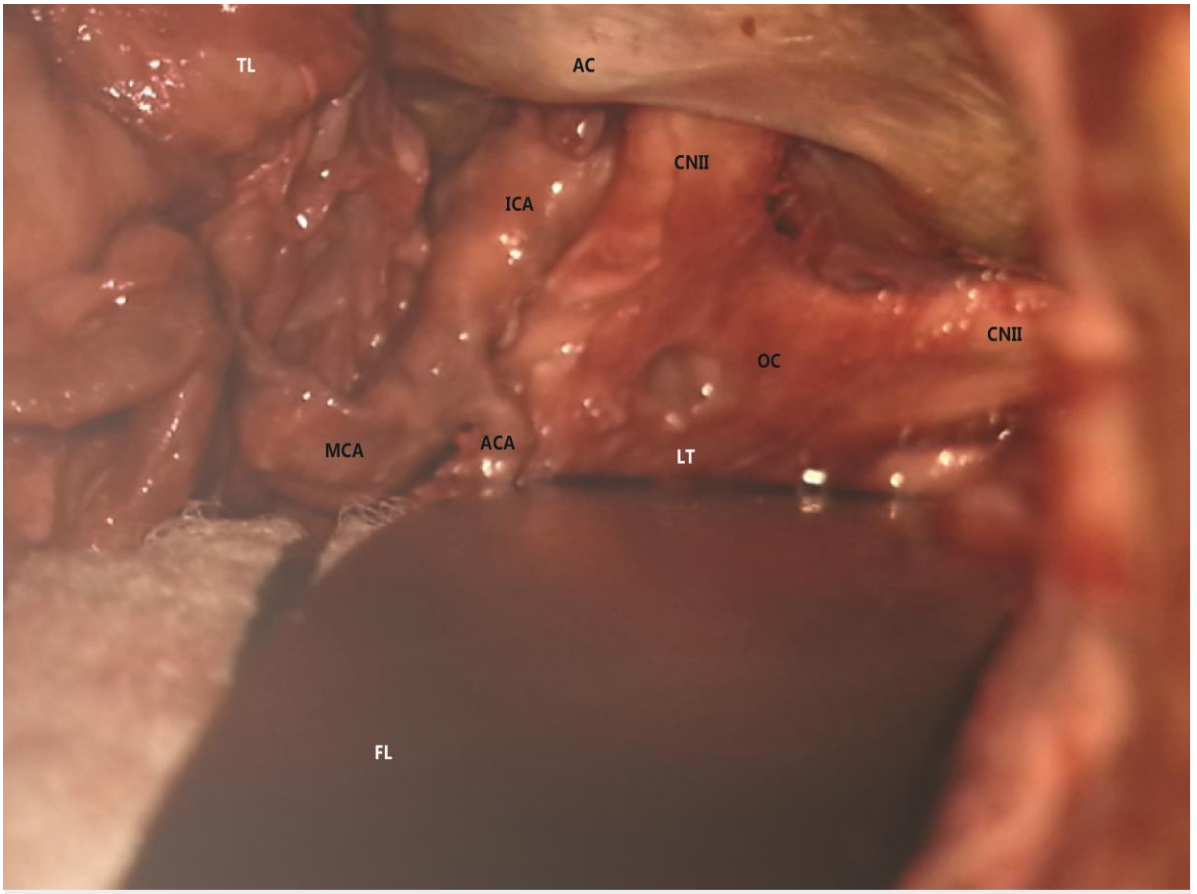
Posterior-medial compartment/insular cleft of sylvain fissure. Intermediate slyvain membrane was dissected.

PT = pars triangularis
MCA = middle cerebral artery
I = insula

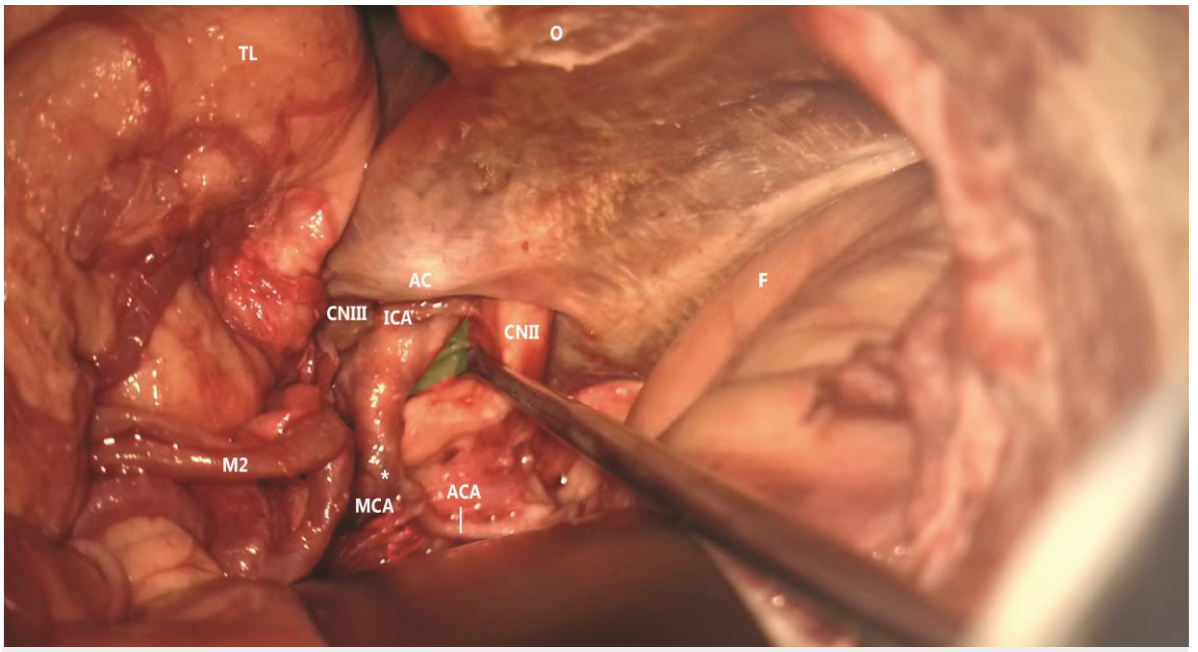
AC = anterior clinoid
M4 = cortical segment of middle cerebral artery



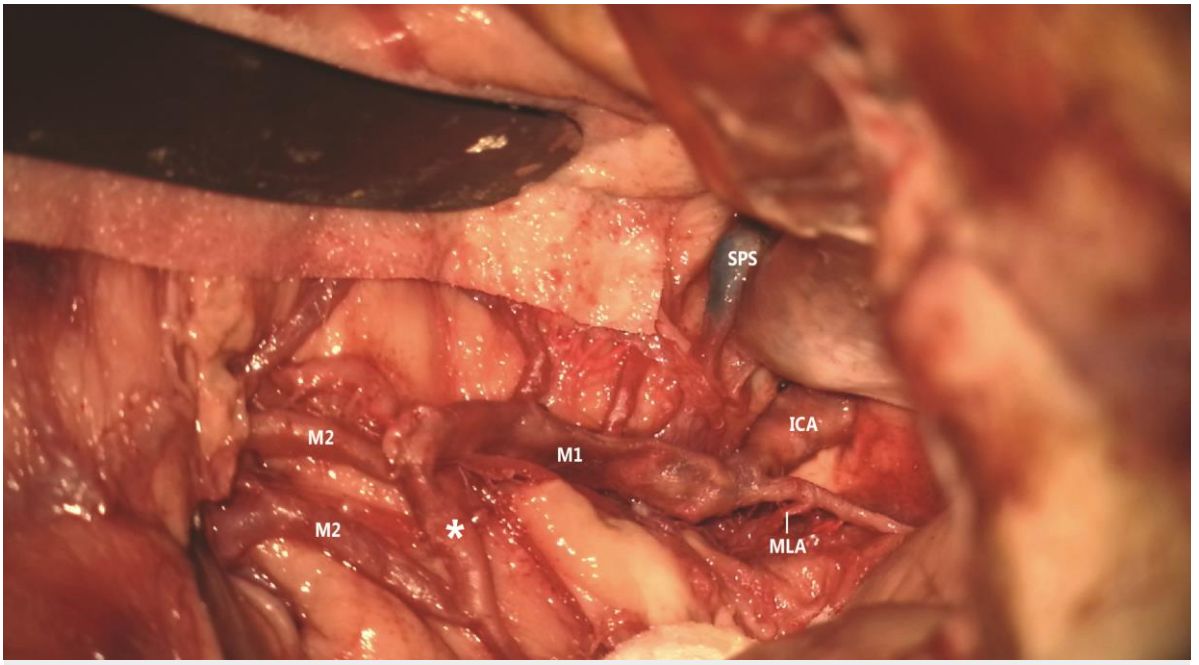
AChA =anterior choroidal artery
PCOMM = Posterior communicating artery
CN II = optic Nerve
AC = anterior clinoid
ICA = internal carotid artery
TL = temporal lobe
FL = frontal lobe



CN II = optic nerve
AC = anterior clinoid
ICA = internal carotid artery
TL = temporal lobe
OC = optic chiasma
MCA = middle cerebral artery
ACA = anterior cerebral artery
ICA = internal cartiod artery
LT = laminated terminalis.

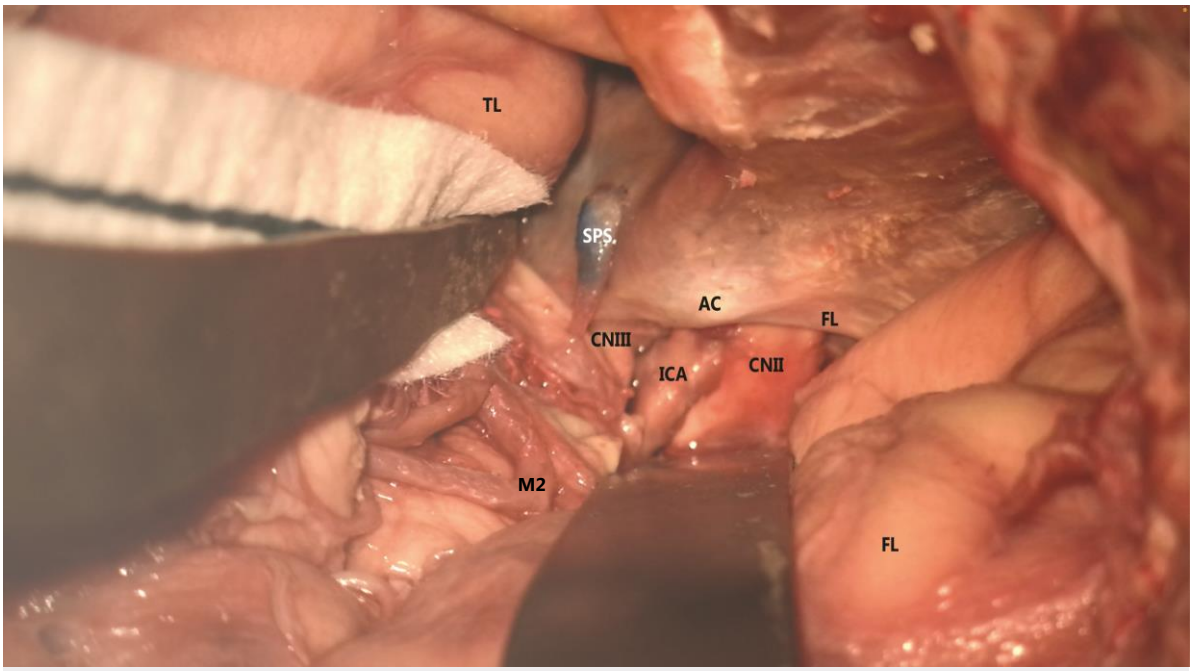


Green triangle = optoic-carotid tringle
CN II = optic nerve
CN III = oculomotor nerve
AC = anterior clinoid
ICA = internal carotid artery
MCA = middle cerebral artery
ACA = anterior carotid artery
Asterisk = carotid bifurcation
TL = temporal lobe
O = orbit
M2 = insular segment

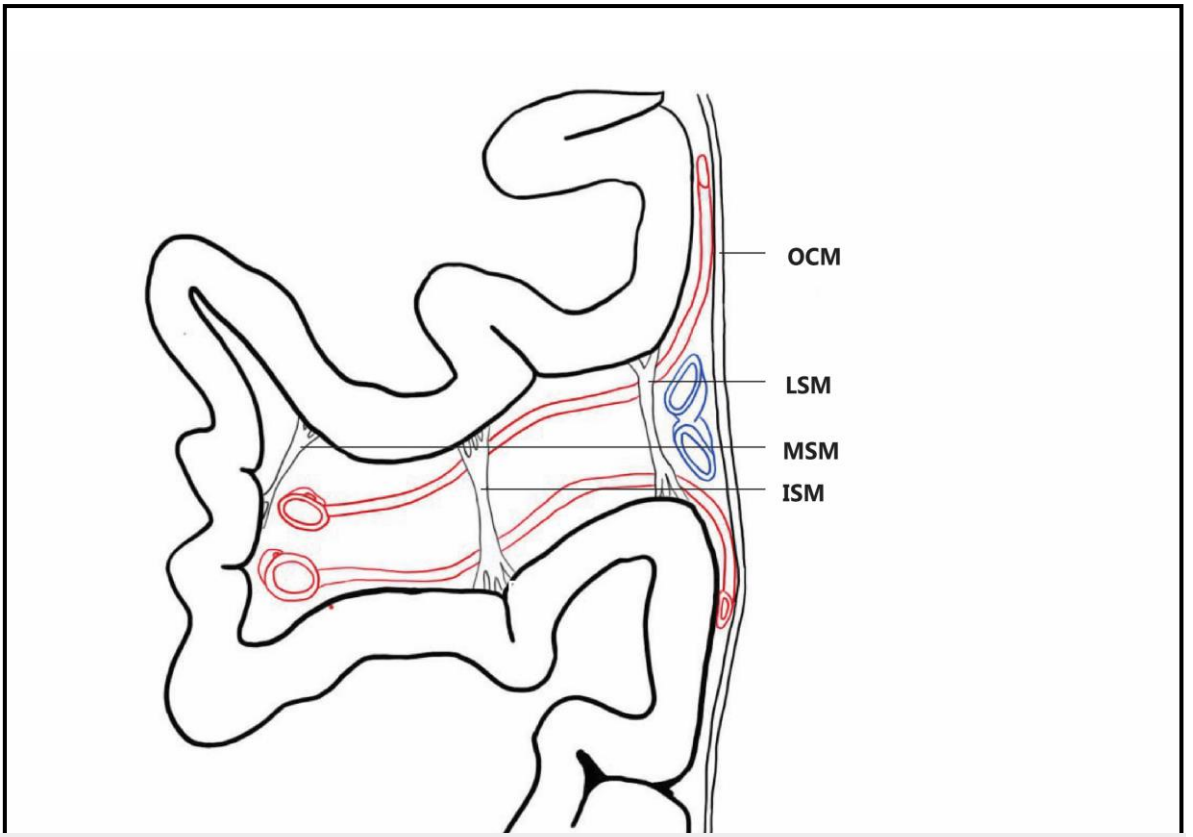


MLA = medial lenticulostriate arteries
SPS = sphenopalatine sinus
M2= insular segment of middle cerebral artery
M1= sphenoidal segment of middle cerebral artery

Asterisk = trifurcation
ICA = internal carotid artery treminus

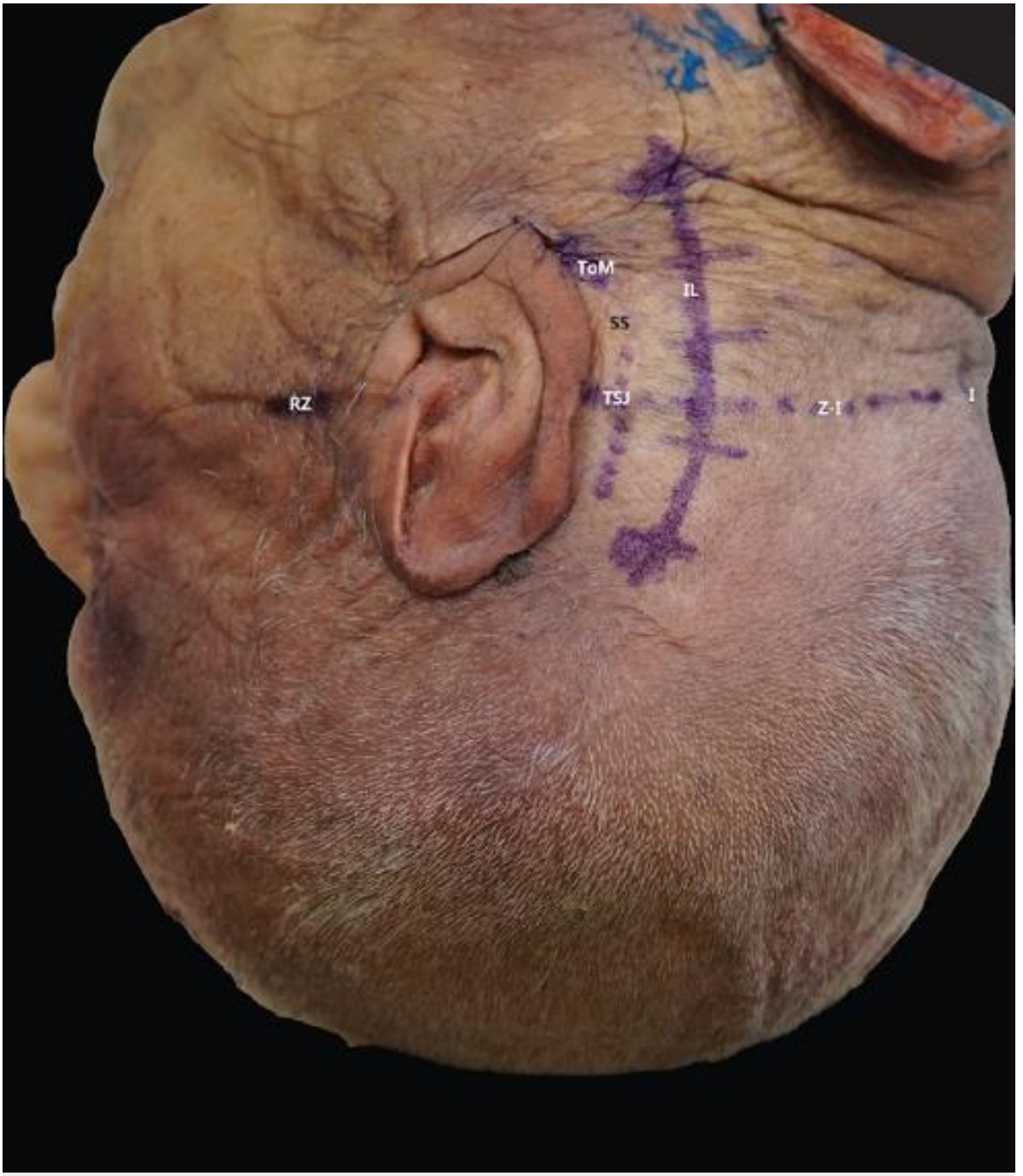


TL = temporal lobe
FL = frontal lobe
SPS = sphenopalatine sinus
AC = anterior clinoid
CN II = left sided optic nerve
FL = Falciform ligament
CN III = oculomotor nerve
ICA = terminal internal carotid artery



Anterior Temporal Lobectomy and Amygdalo Hippocampectomy

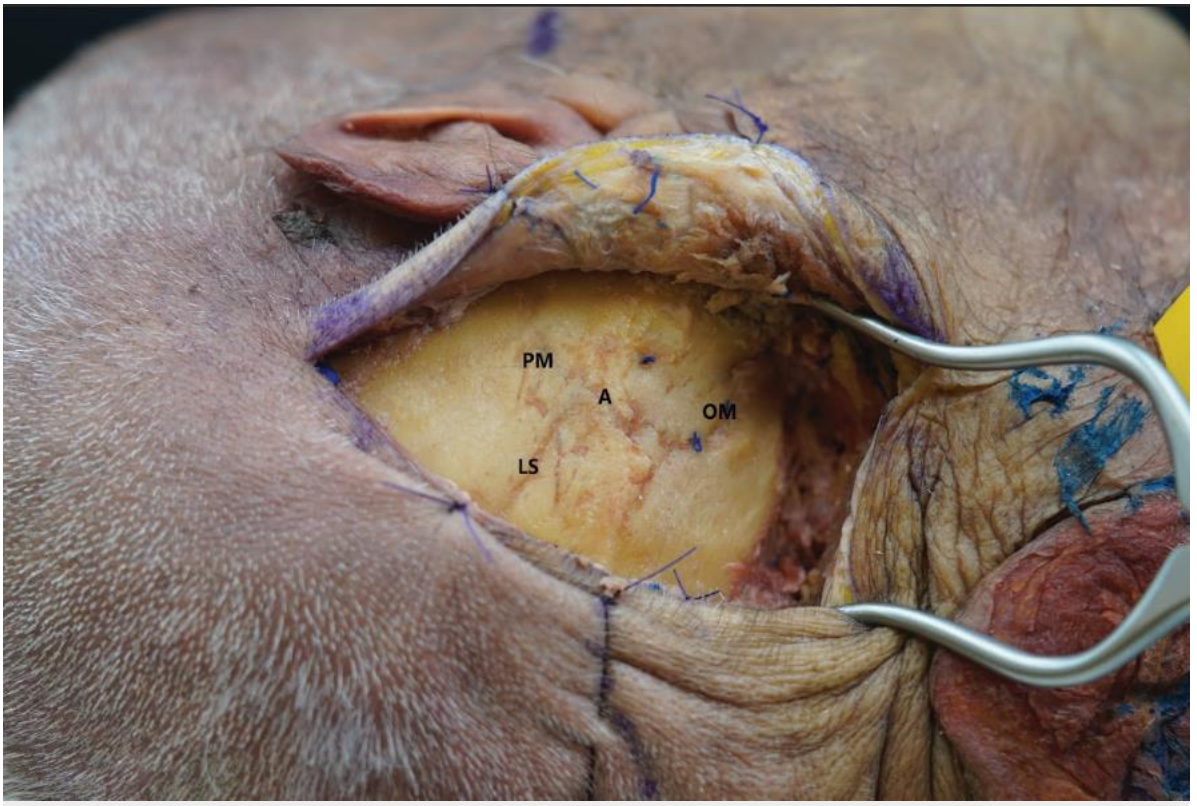
OCM = Outer arachnoid membrane
LSM = Lateral Sylvian membrane
ISM = Intermediate Sylvian membrane
MSM = Medial Sylvian membrane



The skin incision is variable. Demonstrated here is a C-shaped incision two finger breadths from the junction of the pinna to the scalp. One third of the incision was located superior to the imaginary zygoma-nion (Z-line) and two thirds of the incision below it. The Z-line is an imaginary line to approximately the location of the transverse sinus. It extends from the root of the zygoma (RZ) to the inion (I). Another demonstrated line is starting posterior to the mastoid and extending superiorly. The intersection of the two lines is an approximation of the transverse sigmoid junction (TSJ).

SS = sigmoid sinus

IL = incision line



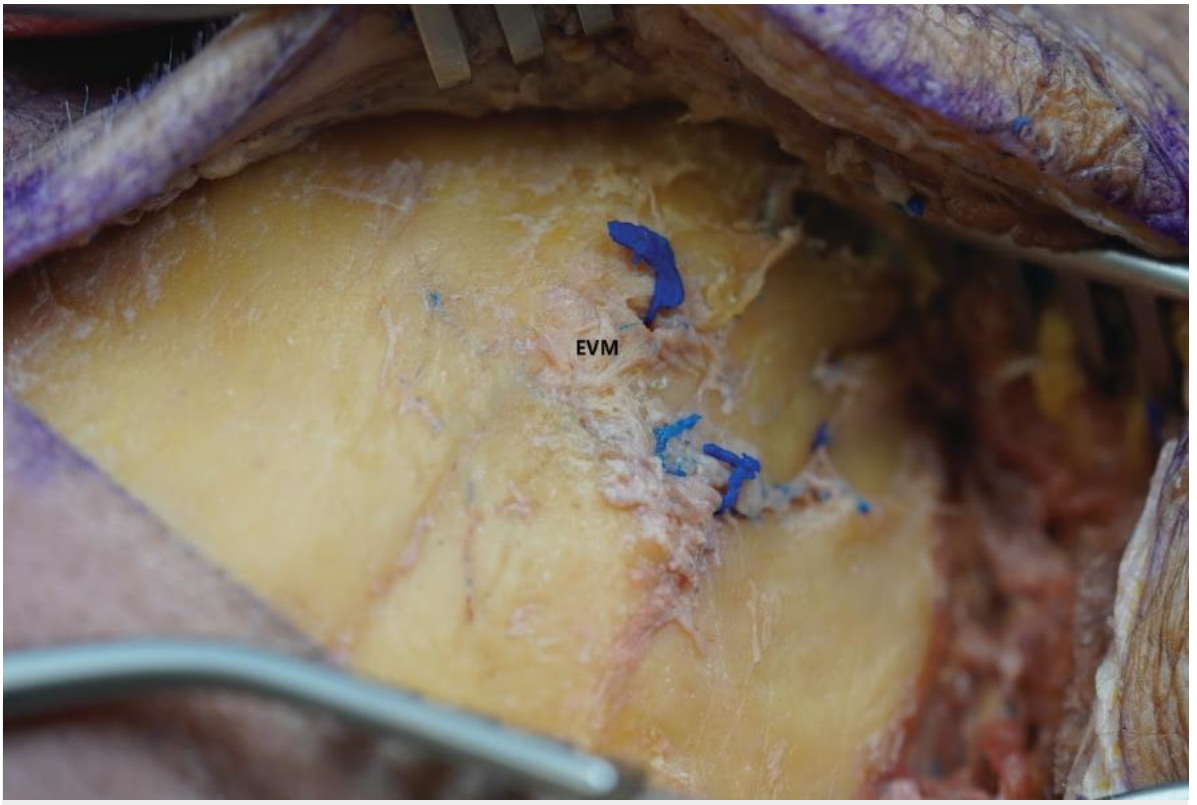
Skin was incised and subperiosteal dissection was performed.

PM = pariatomastoid suture

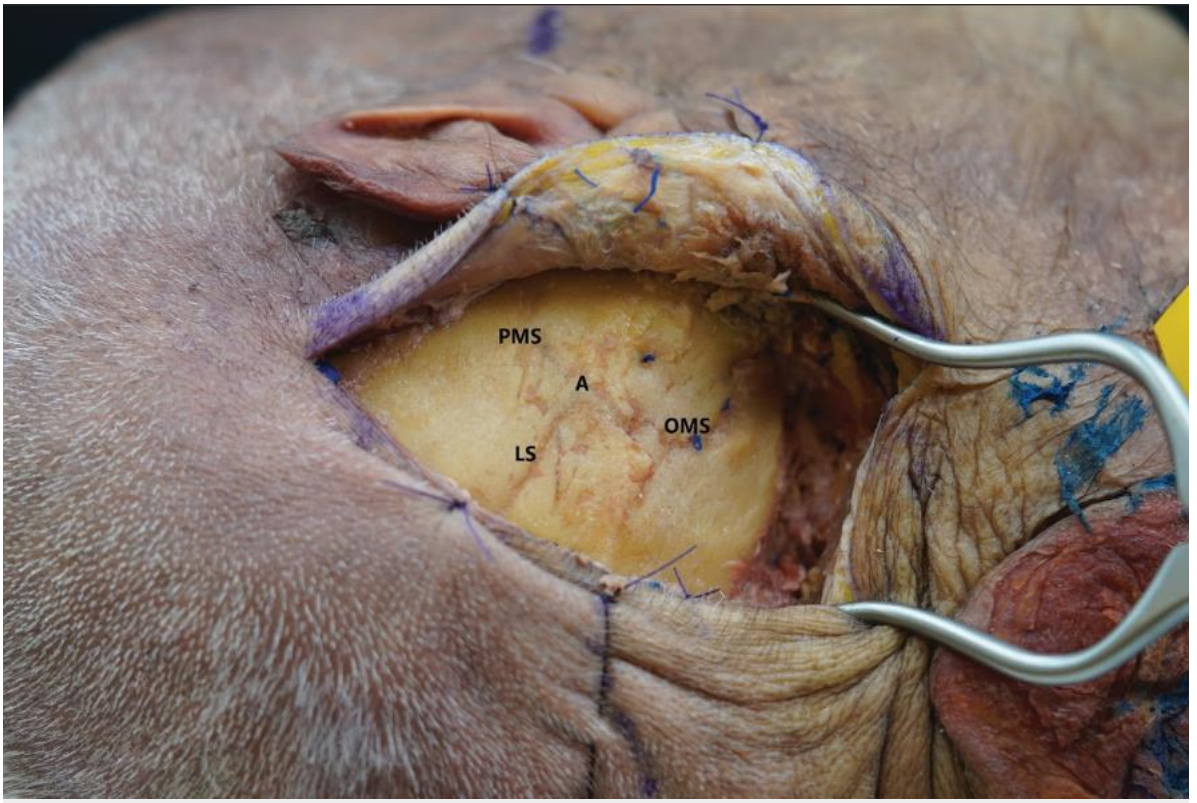
LS = lambdoid suture

OM = occipitomastoid suture

A = asterion



EMV = emissary vein of mastoid



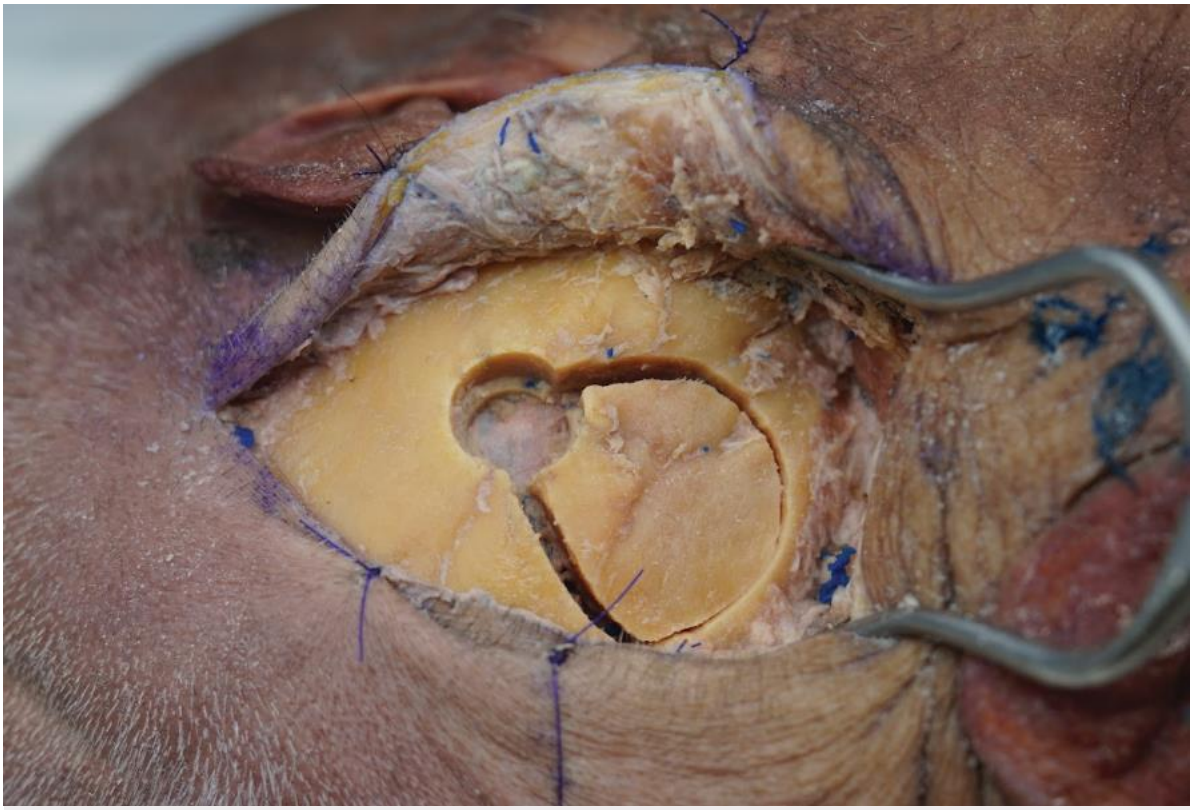
PMS = paraitomastoid suture

OMS = occipitomastoid suture

LS = lambdoid suture

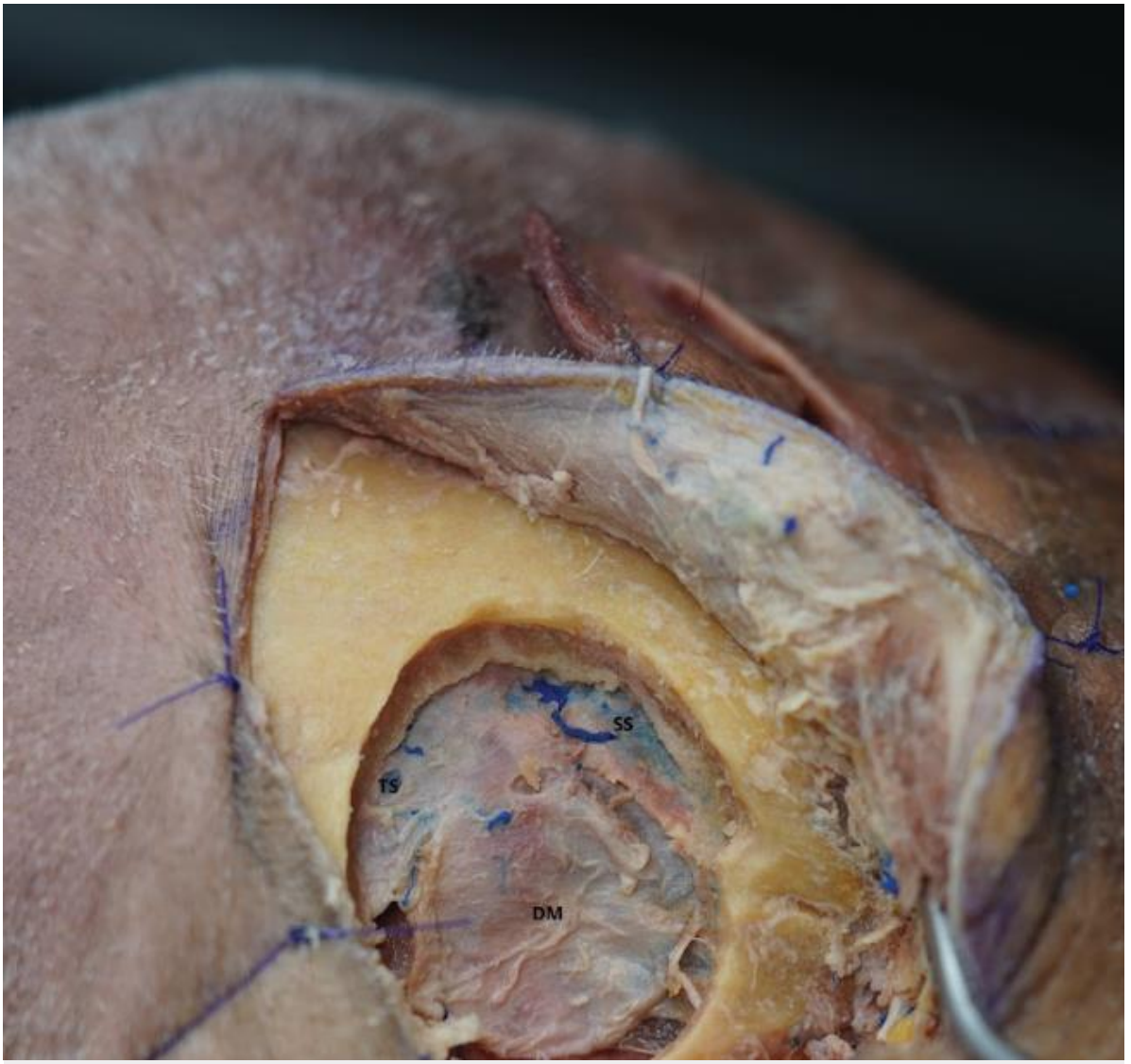
A = asterion

Burr hole was placed over the asterion.



Craniotomy for retrosigmoid approach.

Dura was incised in curvilinear pattern. An additional cut was made to reflect the dura leaflets over the sinuses.

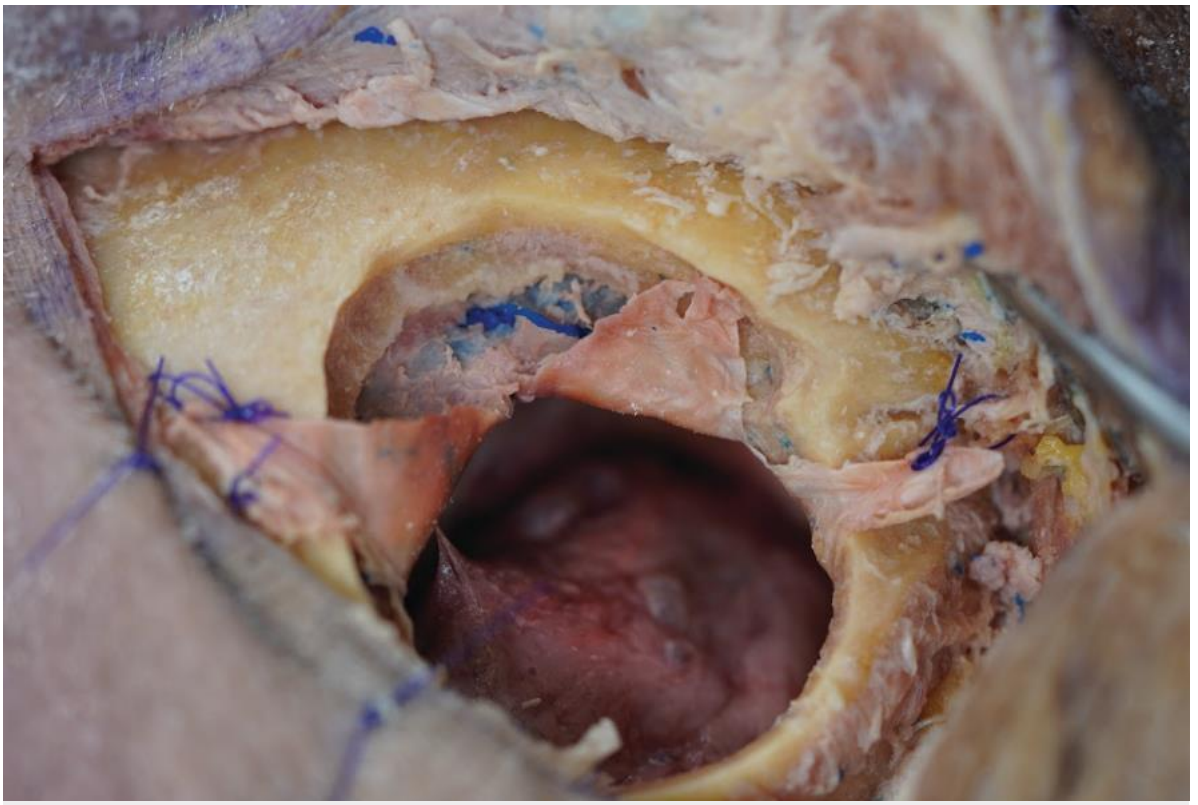


Further drilling was exposed and portion of the sigmoid and transverse sinus is exposed.

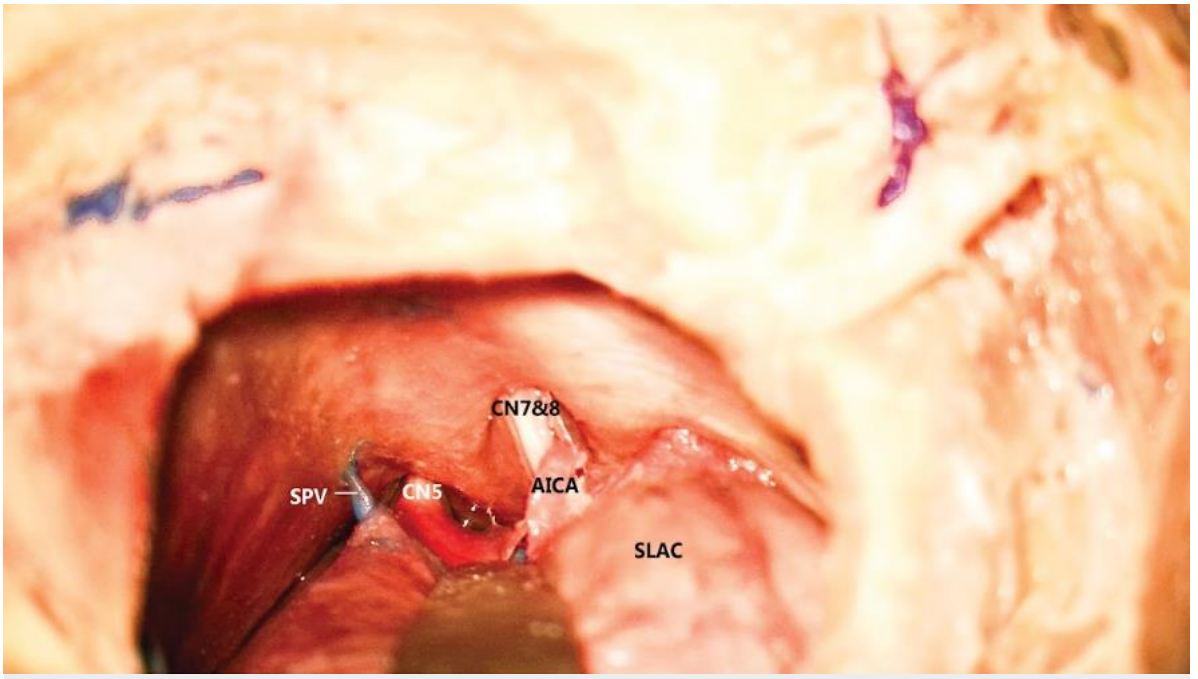
SS = sigmoid sinus

DM = dura mater

TS = transverse sinus



Intracranial expouser of the retrosigmoid approach



Superolateral surface of the cerebellum was retracted and the superior neuro-vascular bundle was exposed.

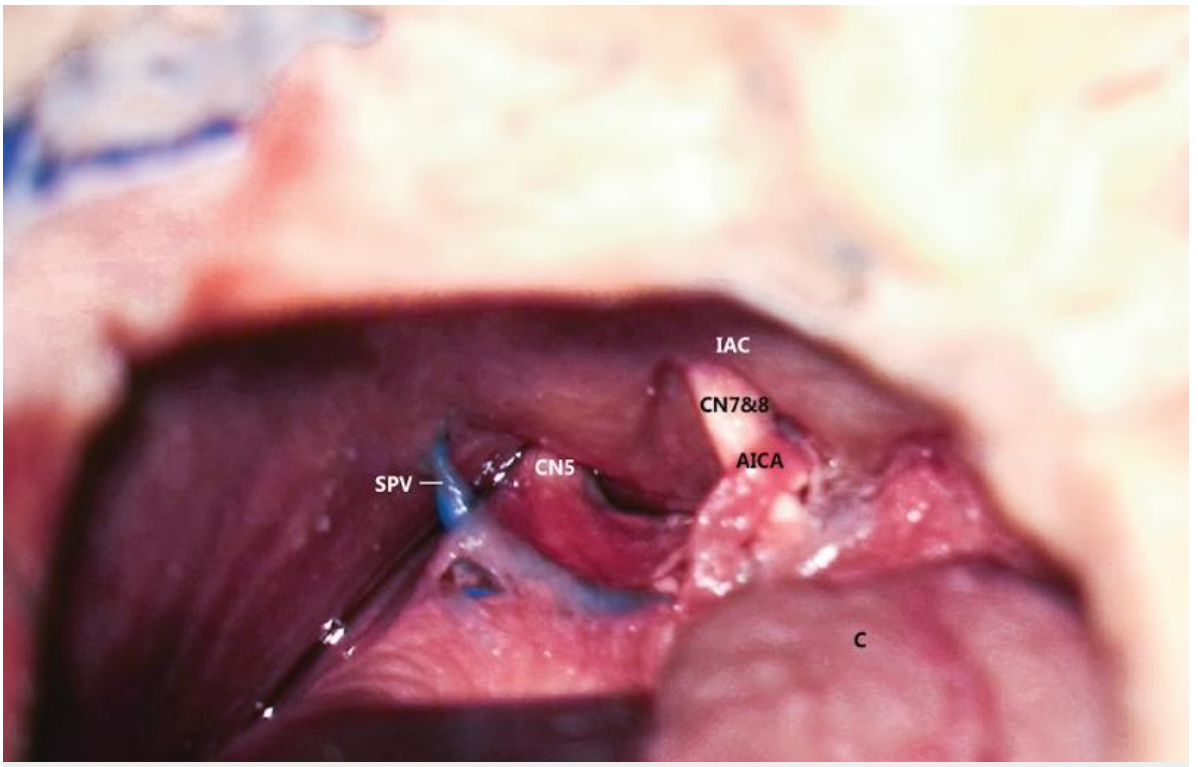
AICA = anterior inferior cerebellar artery

SLAC = superolateral aspect of cerebellum

CNV = trigeminal nerve

CN7&8 = facial and vestibulocochlear nerves

SPV = superior petrosal vein



Retraction placed over the lateral surface of the cerebellum. Exposure of the superior and mid-portion of the cerebellopontine angle.

AICA = anterior inferior cerebellar artery

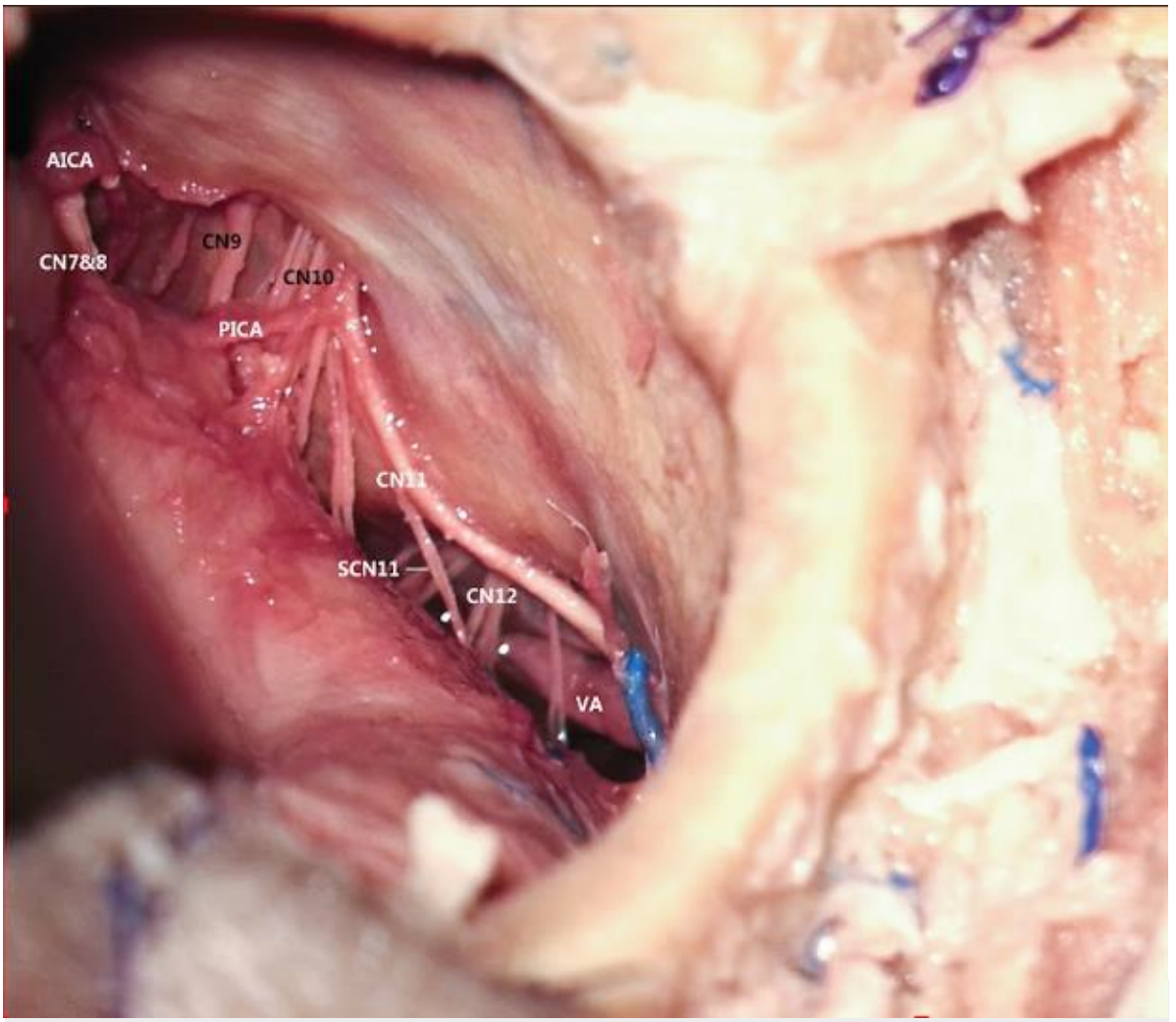
C = cerebellum

CNV = trigeminal nerve

CN7&8 = facial and vestibulocochlear nerves

SPV = superior petrosal vein

IAC = internal auditory canal



The inferolateral surface of the cerebellum was retracted to expose the inferior neurovascular bundle of the cerebellopontine angle. Exposing the infralateral portion of the cerebellopontine angle.

AICA = anterior inferior cerebellar artery

CN10 = vagus nerve

CN9 = glossopharyngeal nerve

CN11 = accessory nerve

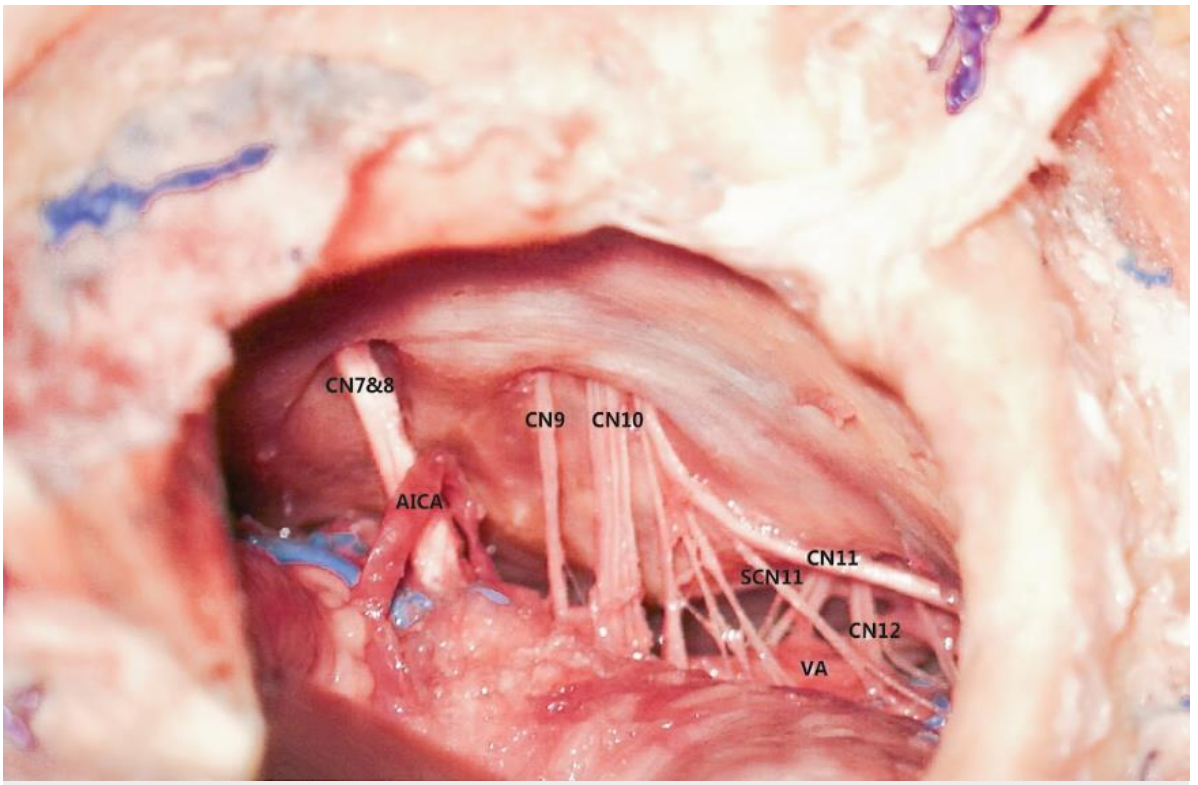
CN12 = hypoglossal nerve

CN7&8 = facial and vestibulocochlear nerves

VA = vertebral artery

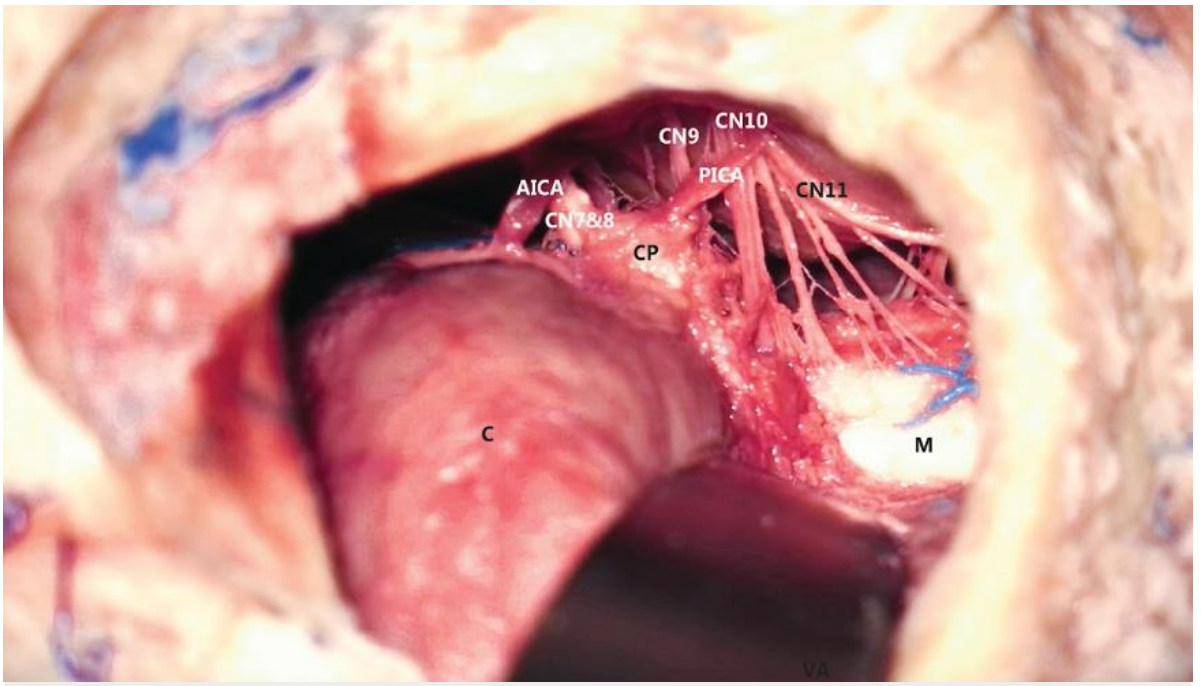
SCN11 = spinal branch of accessory nerve

PICA = posterior inferior cerebellar artery



The inferolateral surface of the cerebellum was retracted to expose the inferior neurovascular bundle of the cerebellopontine angle. Exposing the infralateral position of the cerebellopontine angle.

AICA = anterior inferior cerebellar artery
CN10 = vagus nerve
CN9 = glossopharyngeal nerve
CN11 = accessory nerve
CN12 = hypoglossal nerve
CN7&8 = facial and vestibulocochlear nerves
VA = vertebral artery
SCN11 = spinal branch of accessory nerve



Exposure of the inferior neurovascular bundle of the cerebellopontine angle.

PICA = posterior inferior cerebellar artery

CN9 = glossopharyngeal nerve

CN11 = accessory nerve

CN7&8 = facial and vestibulocochlear nerves

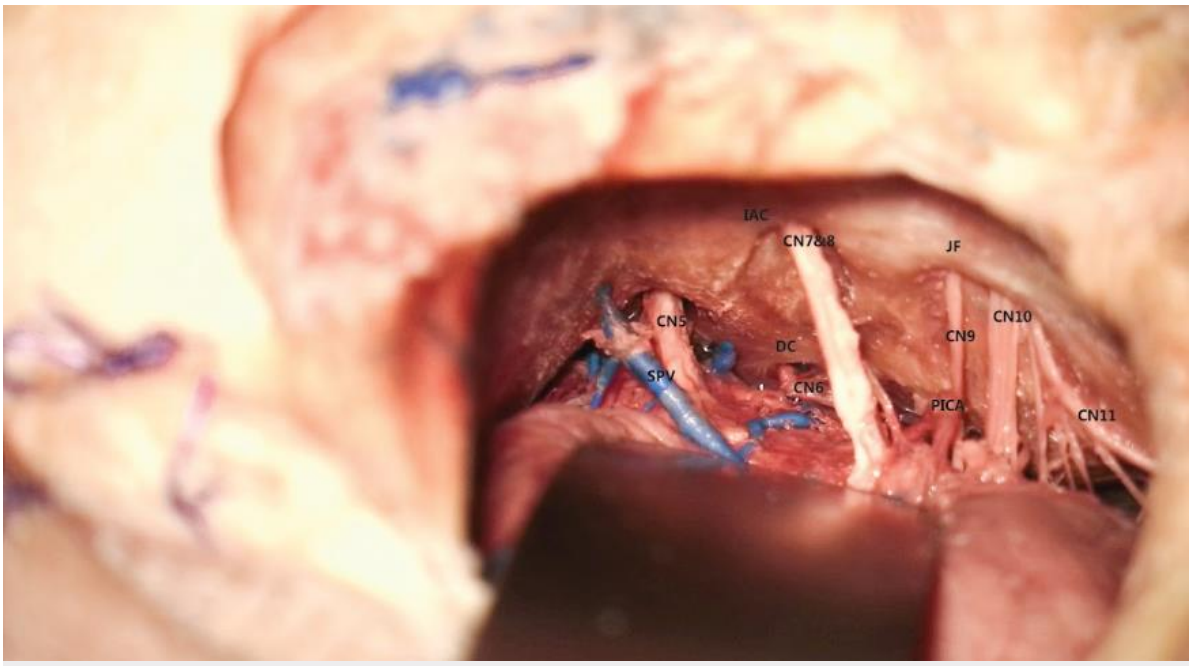
CN11 = accessory

C = cerebellum

CP = choroid plexus

AICA = anterior inferior cerebellar artery

M = medulla



Retraction placed over the lateral surface of the cerebellum. Exposing the inferolateral position of the cerebellopontine angle.

PICA = posterior inferior cerebellar artery

CN9 = glossopharyngeal nerve

CN11 = accessory nerve

CN7&8 = facial and vestibulocochlear nerves

CN11 = accessory

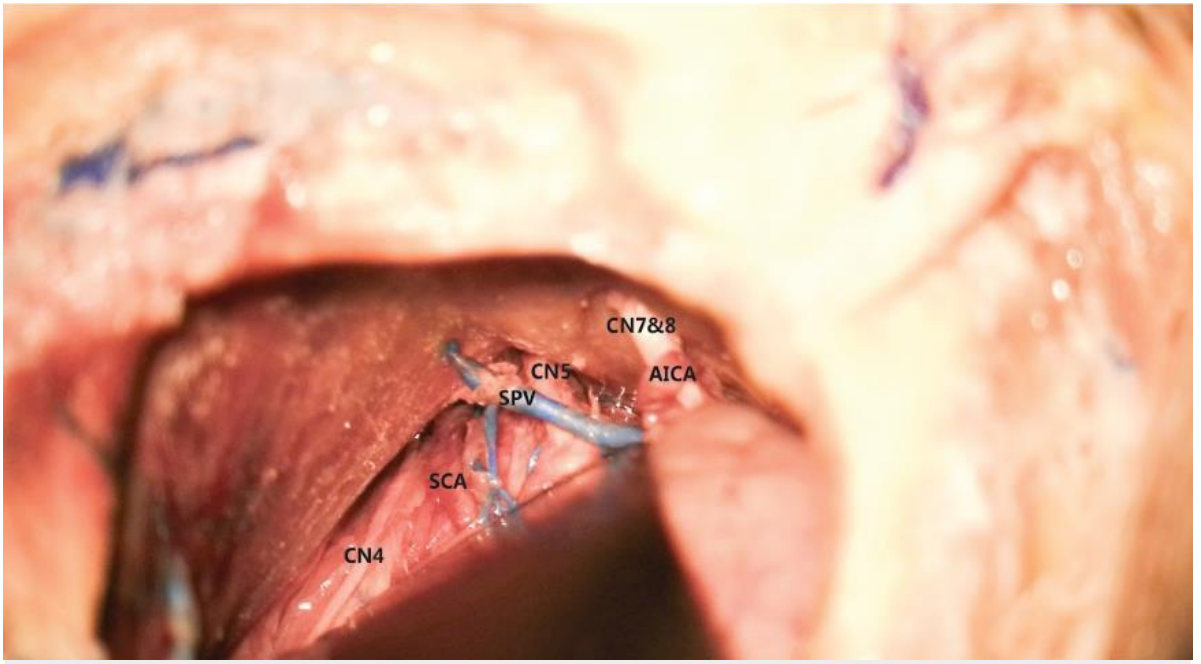
SPV = superior petrosal vein

IAC = internal auditory canal

JF = jugular foramen

DC = Dorello's canal

CN6 = Abducent nerve



Exposure of the superior compartment of the cerebellopontine angle.

SCA = superior cerebellar artery

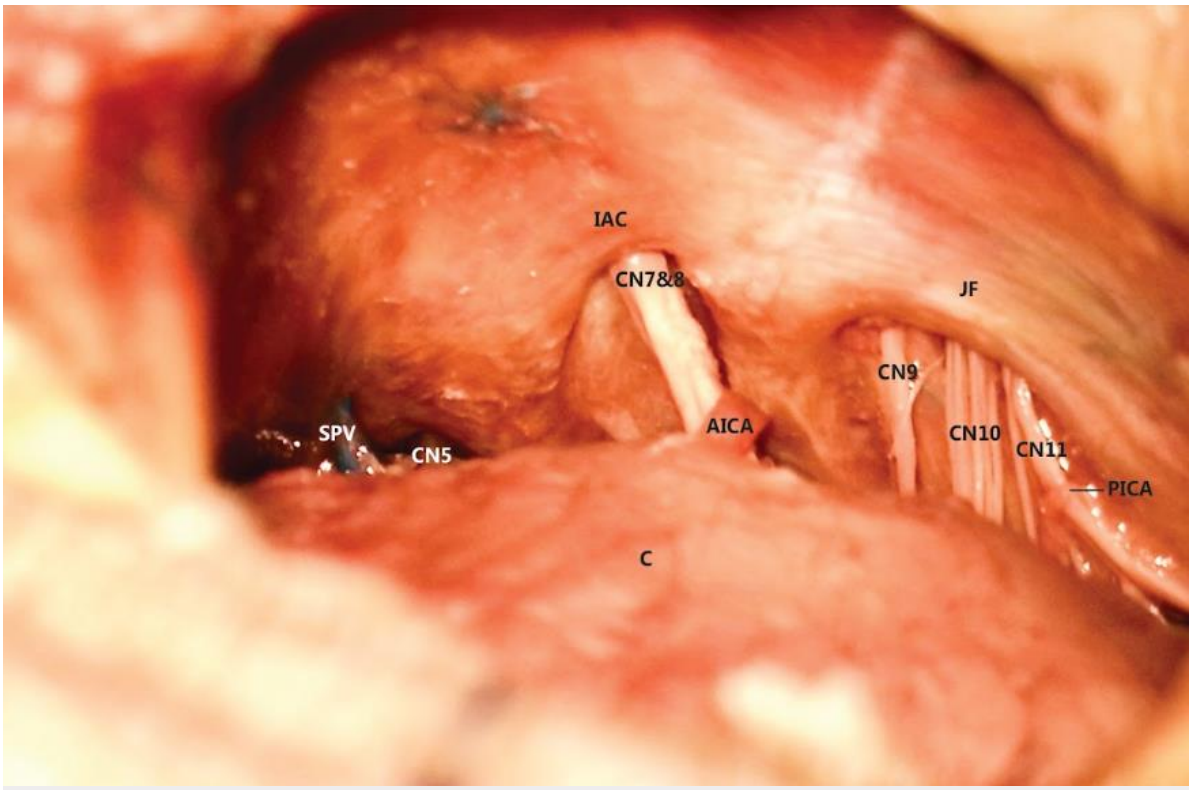
AICA = anterior inferior cerebellar artery

CN7&8 = facial and vestibulocochlear nerves

SPV = superior petrosal vein

CN6 = abducens nerve

CN4 = trochlear nerve



IAC = internal auditory canal

C = cerebellum

AICA = anterior inferior cerebellar artery

CN7&8 = facial and vestibulocochlear nerves

SPV = superior petrosal vein

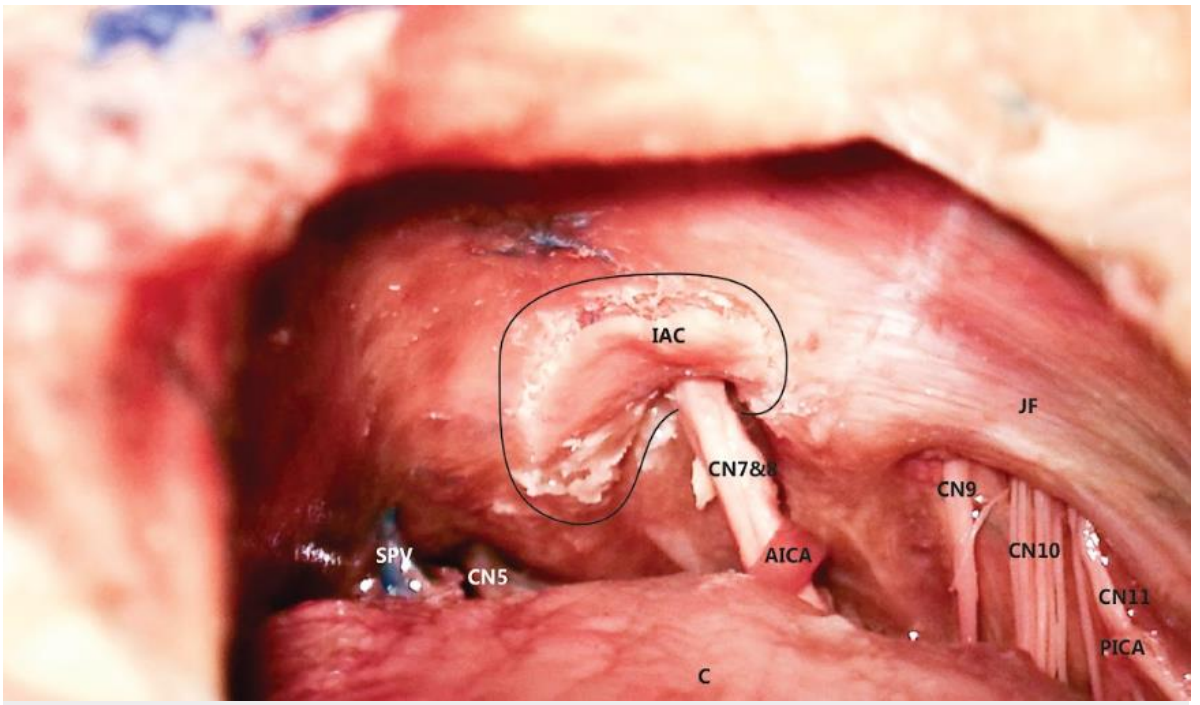
CN9 = glossopharyngeal nerve

CN10 = vagus nerve

CN11 = accessory nerve

CN5 = Trigeminal nerve

PICA = posterior inferior cerebellar artery



The dura over the IAC was incised.

IAC = internal auditory canal

C = cerebellum

AICA = anterior inferior cerebellar artery

CN7&8 = facial and vestibulocochlear nerves

SPV = superior petrosal vein

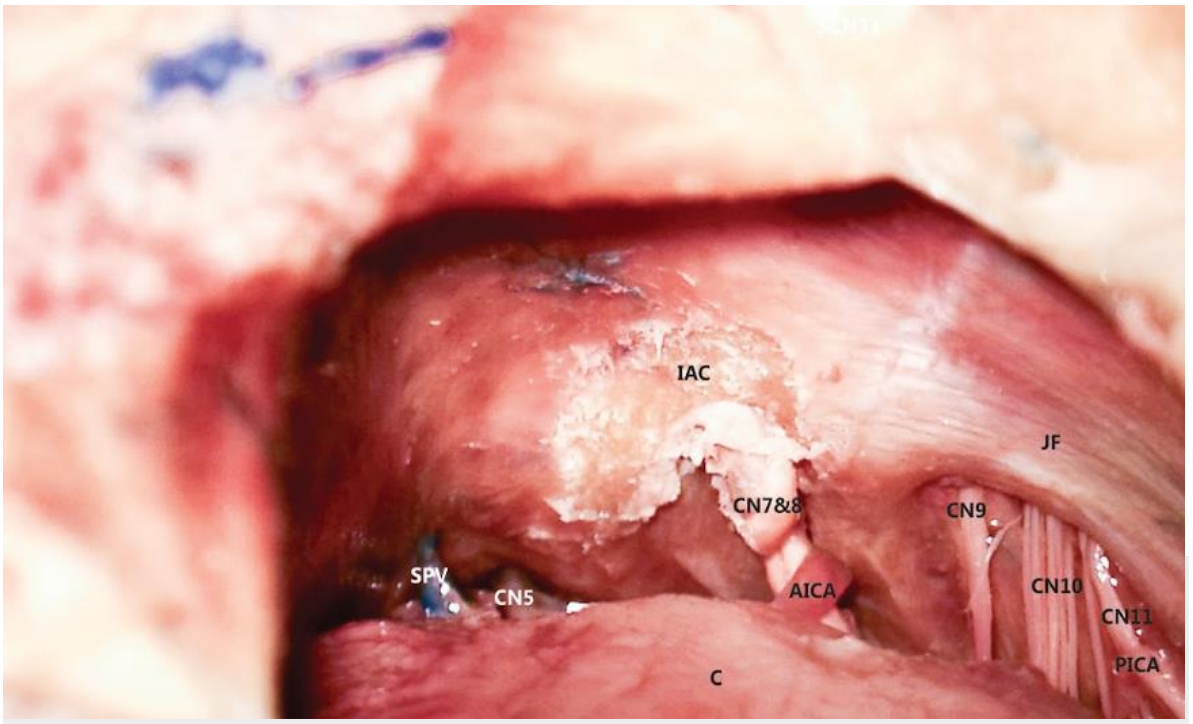
CN9 = glossopharyngeal nerve

CN10 = vagus nerve

CN11 = accessory nerve

CN5 = Trigeminal nerve

PICA = posterior inferior cerebellar artery



IAC = internal auditory canal

C = cerebellum

AICA = anterior inferior cerebellar artery

CN7&8 = facial and vestibulocochlear nerves

SPV = superior petrosal vein

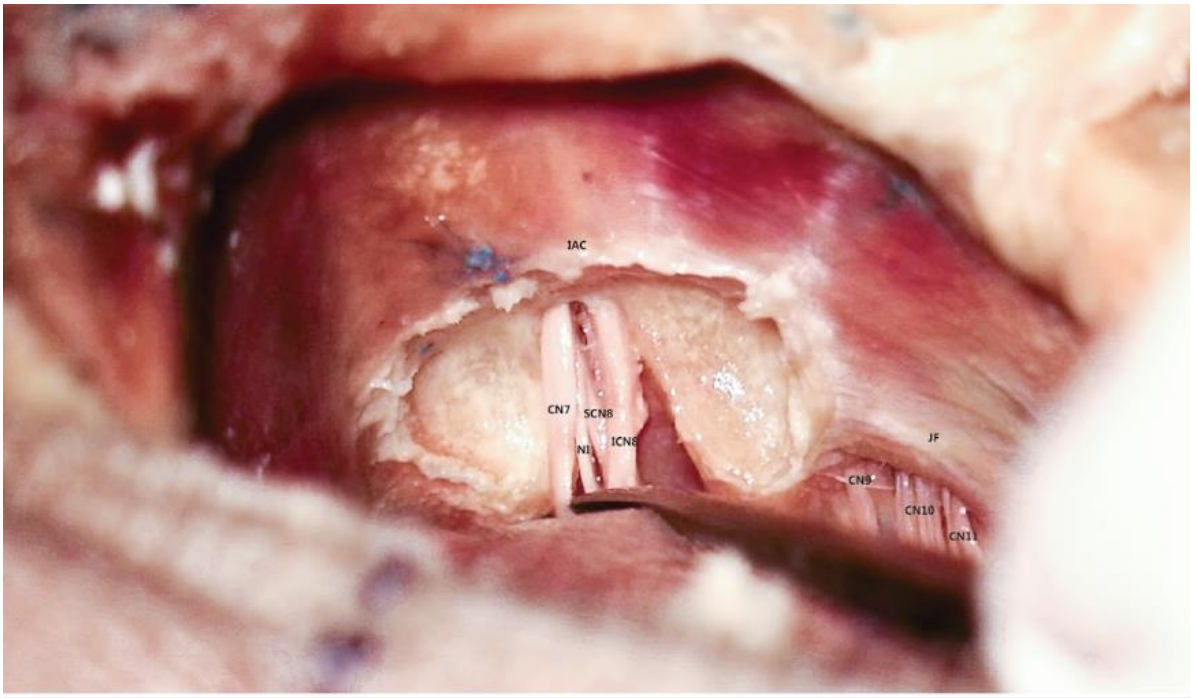
CN9 = glossopharyngeal nerve

CN10 = vagus nerve

CN11 = accessory nerve

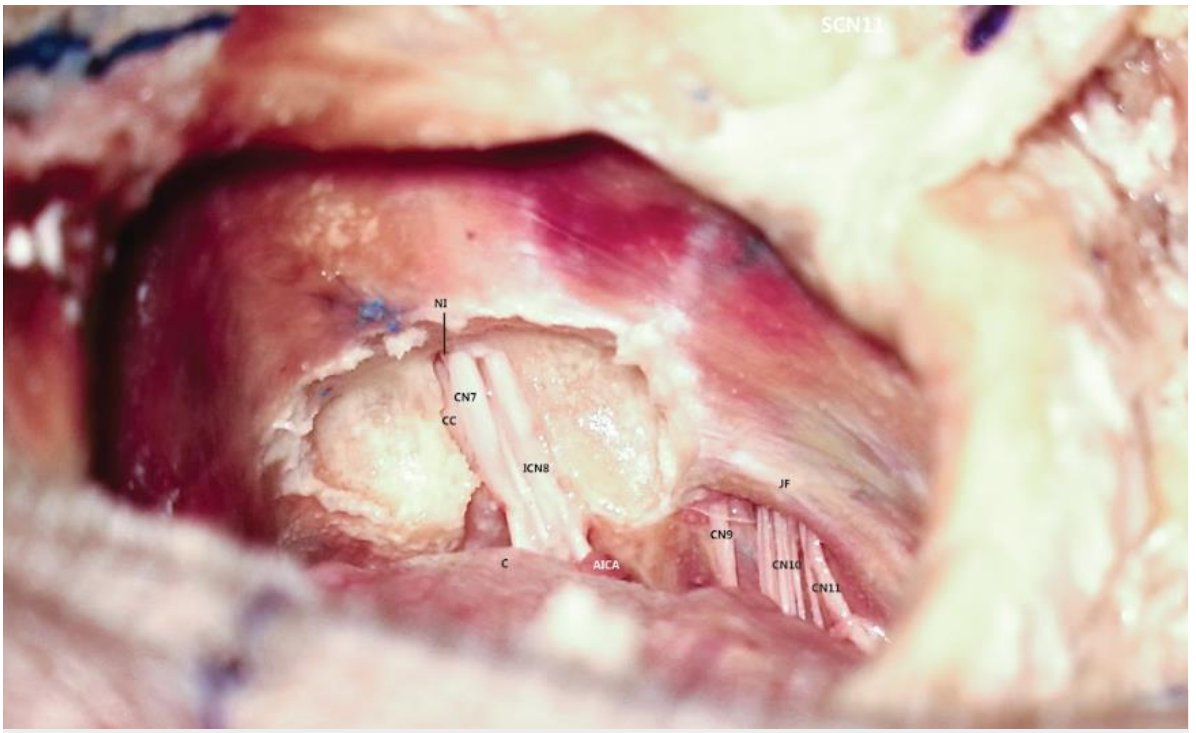
CN5 = Trigeminal nerve

PICA = posterior inferior cerebellar artery



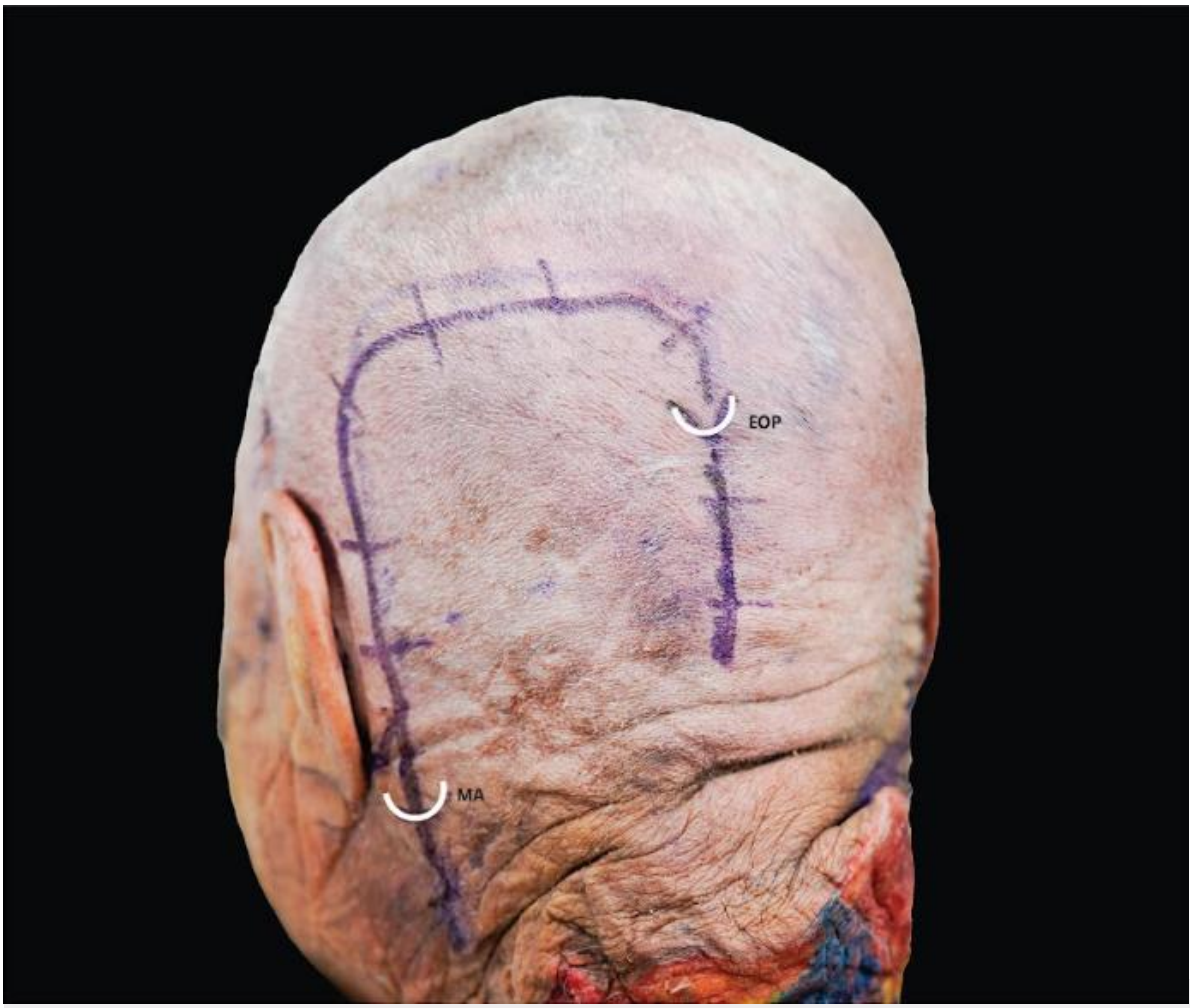
The posterior wall of the IAC was removed.

IAC = internal auditory canal
CN7 = facial nerve
CN9 = glossopharyngeal nerve
CN10 = vagus nerve
CN11 = accessory nerve
NI = nervus intermedius
SCN8 = superior vestibular nerve
JF = jugular foramen



The posterior wall of the IAC was drilled.

IAC = internal auditory canal
C = cerebellum
AICA = anterior inferior cerebellar artery
CN7 = facial nerve
CN9 = glossopharyngeal nerve
CN10 = vagus nerve
CN11 = accessory nerve
CC = cochlear branch of the facial nerve
NI = nervus intermedius

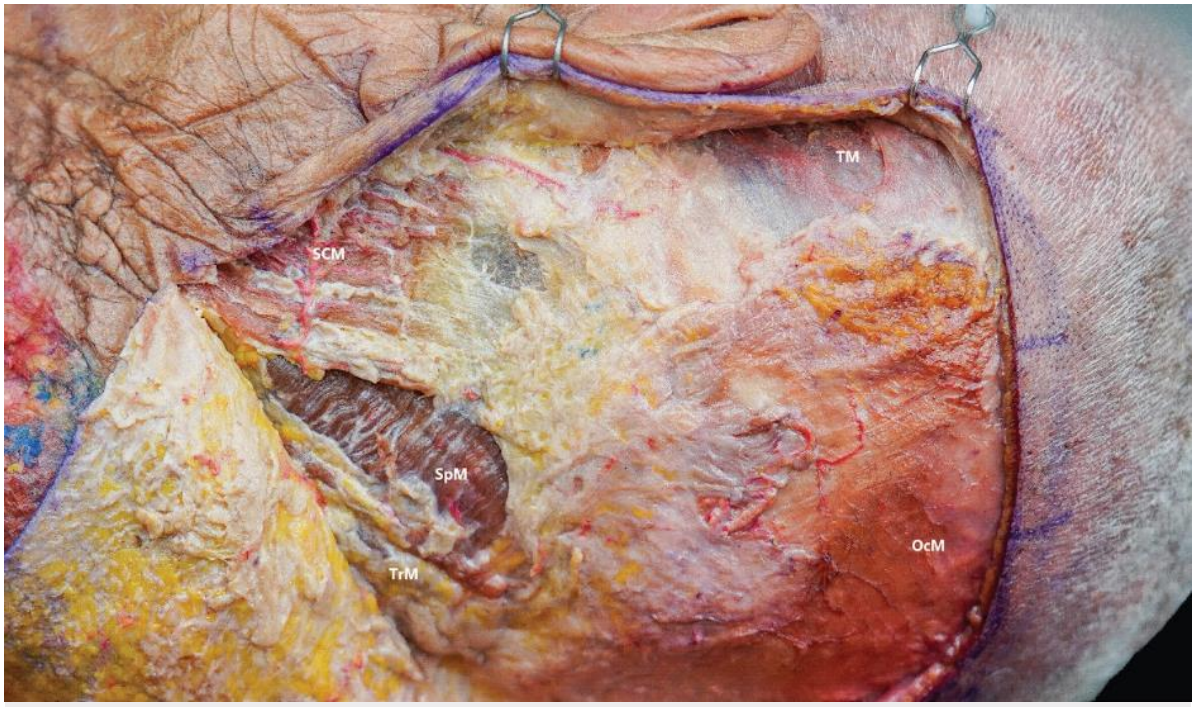


Performe horse-shoe incision (5 cm below the external occipital protuberance (EOP) in the mid-line, extending superiorly and laterally over the superior nuchal line then directed downward parallel to the posterior border of the sternocleidomastoid muscle and ends 4-5 cm below mastoid apex (MA)). Palpate the transverse process of the C1 between the mandibular angle and mastoid apex.

Demonstration of the skin incision variations. The lazy S incision.

Skin and subcutaneous tissue were reflect inferiorly.

TrM = Trapezius muscle
S = skin and subcutaneous fat
OA = occipital artery



Exposure of the superficial and middle muscle layers.

SCM = sternocleidomastoid muscle
TM = temporalis muscle

TrSCM = sternocleidomastoid muscle
TM = temporalis muscle

SpM = splenius capitis muscle

SCM = sternocleidomastoid muscle

Solid black line = superior nuchal line

LS = lambdoid suture

SNL = superior nuchal line
SpNL = supreme nuchal lines

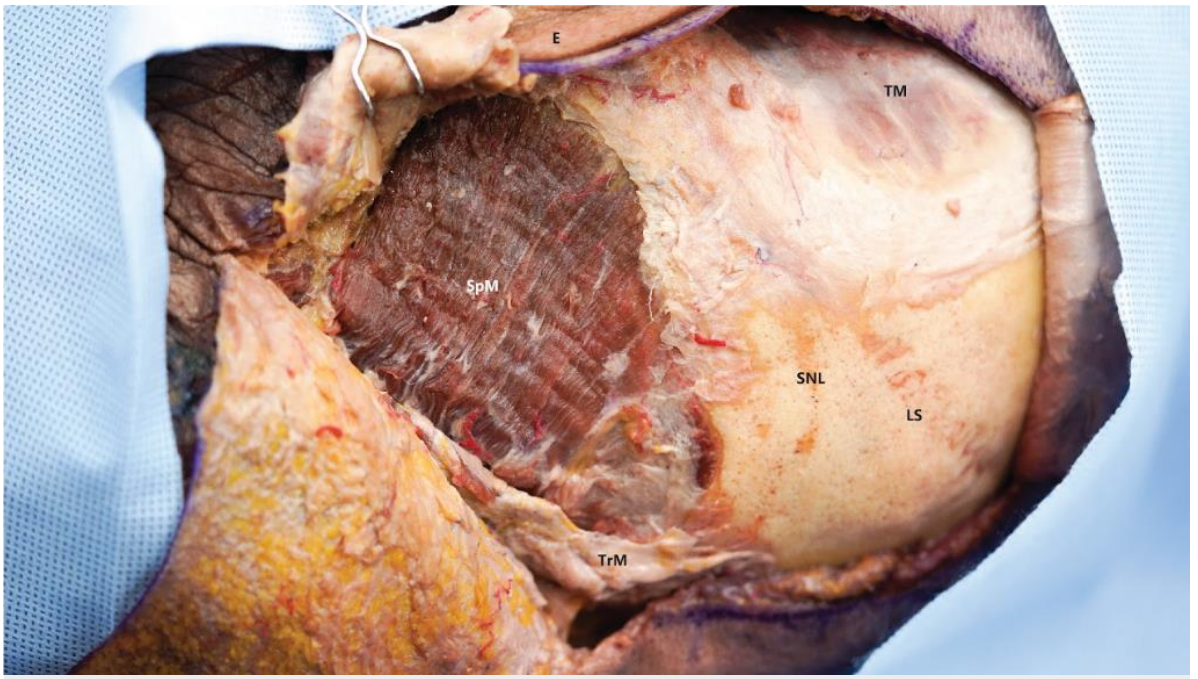
SCM = sternocleidomastoid muscle

LS = lambdoid suture

Solid black line = superior nuchal line

SpNL = supreme nuchal lines

Yellow dashed line = upper portion of occipital triangle



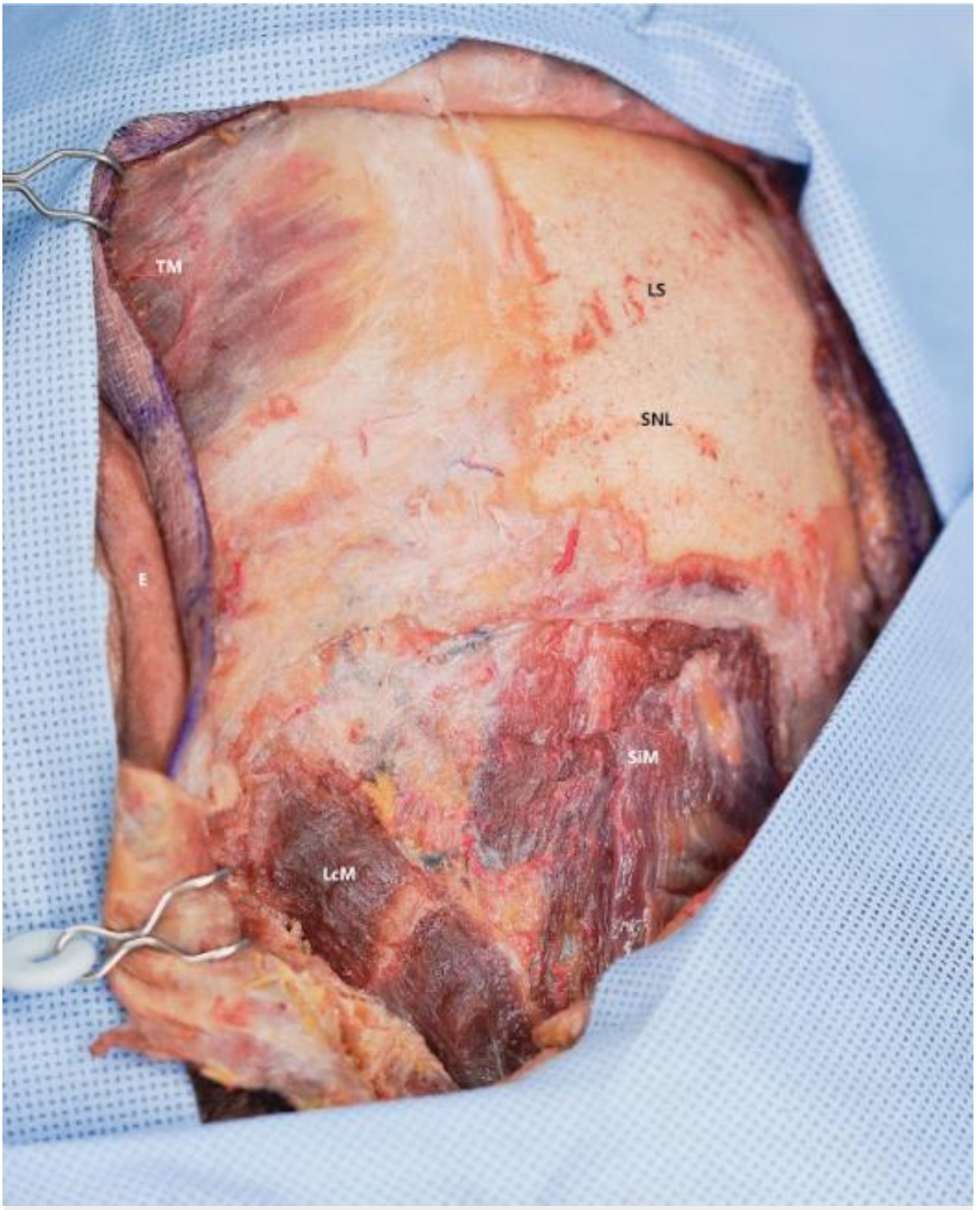
The sternocleidomastoid was reflected laterally, the splenius capitis muscle (SpM) was exposed.

TM = temporalis muscle

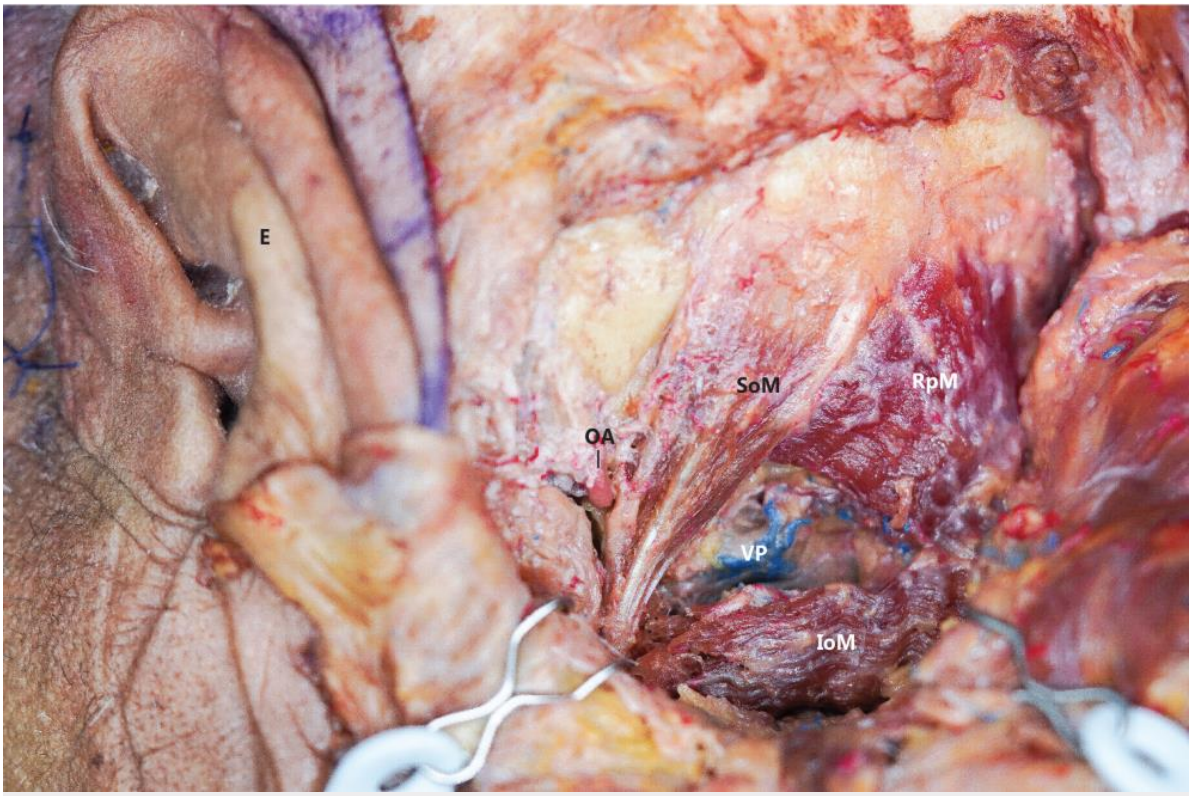
LS = lambdoid suture

TrM = trapezius muscle

E = ear



TM = temporalis muscle
LcM = longus capitis muscle
SiM = semispinalis capitis muscle
E = ear
LS = lambdoid suture
SNL = superior nuchal line



The suboccipital triangle is formed by three muscles: the superior oblique, the rectus capitis minor, and the rectus capitis major.

SoM = superior oblique muscle

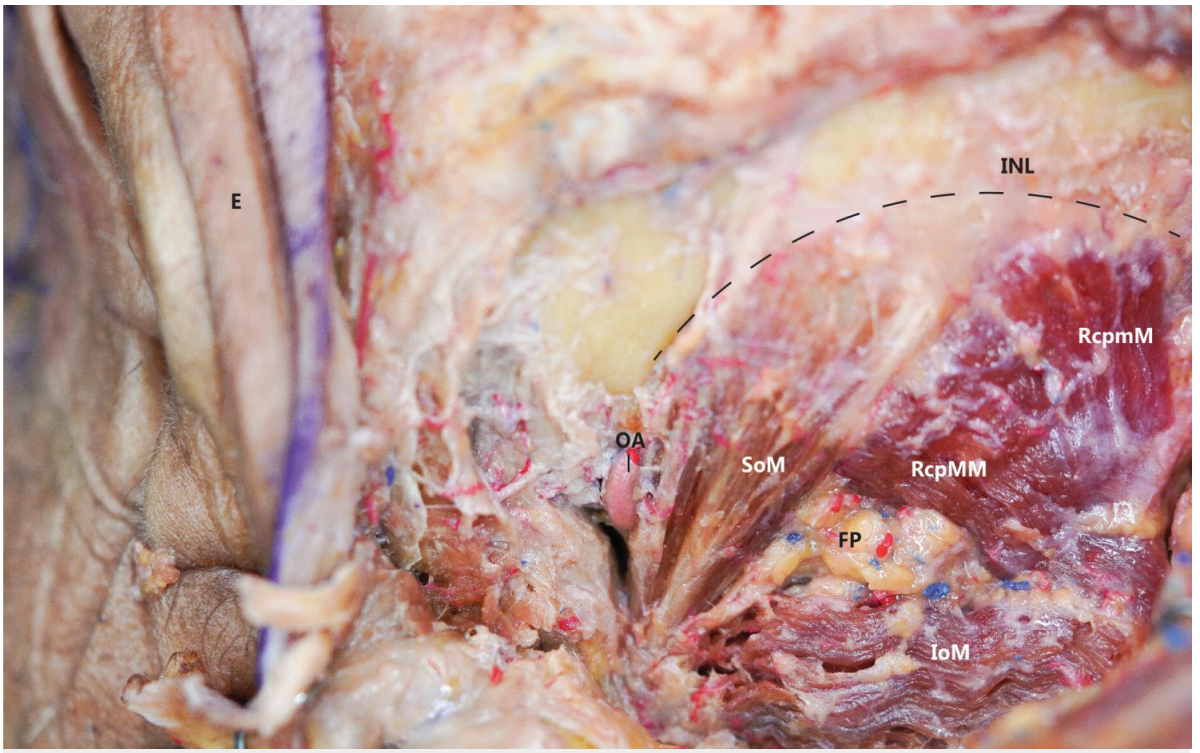
IoM = inferior oblique muscle

RpM = rectus capitis posterior major

E = ear

VP = venous plexus in fat pad

OA = occipital artery



The three muscles superior oblique, rectus capitis minor, rectus capitis major muscles are creating the suboccipital triangle.

SoM = superior oblique muscle

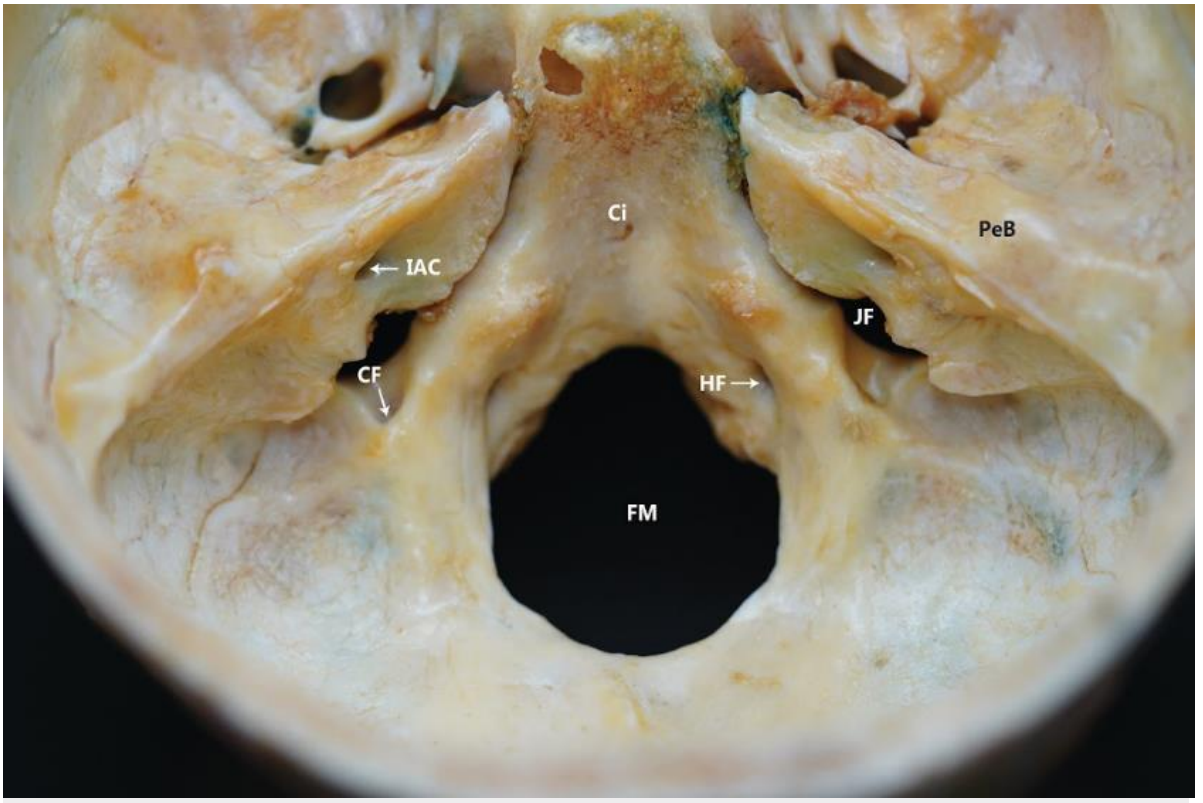
IoM = inferior oblique muscle

RpM = rectus capitis posterior major

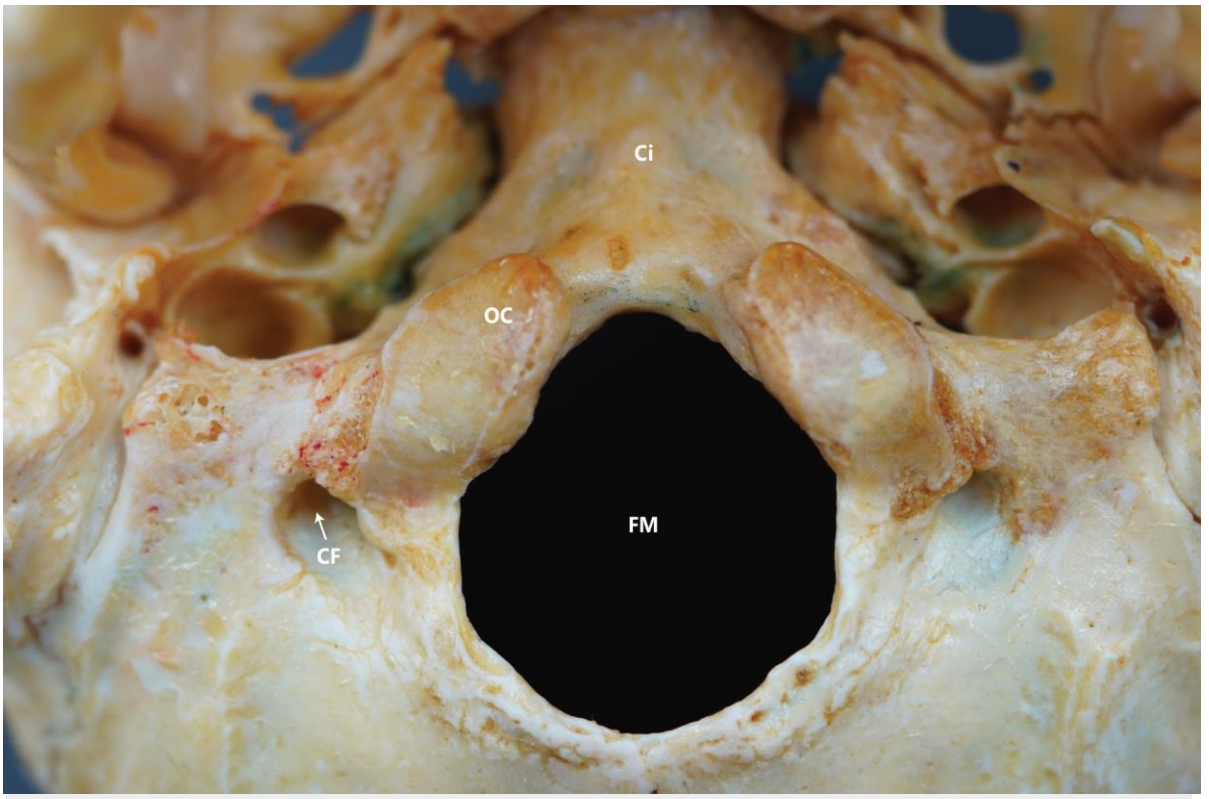
E = ear

FP = fat pad

OA = occipital artery



FM = foramen magnum
Ci = clivus
HF = hypoglossal foramen
CF = condylar foramen
PeB = petrosal bone
JF = jugular foramen
IAC = internal auditory canal

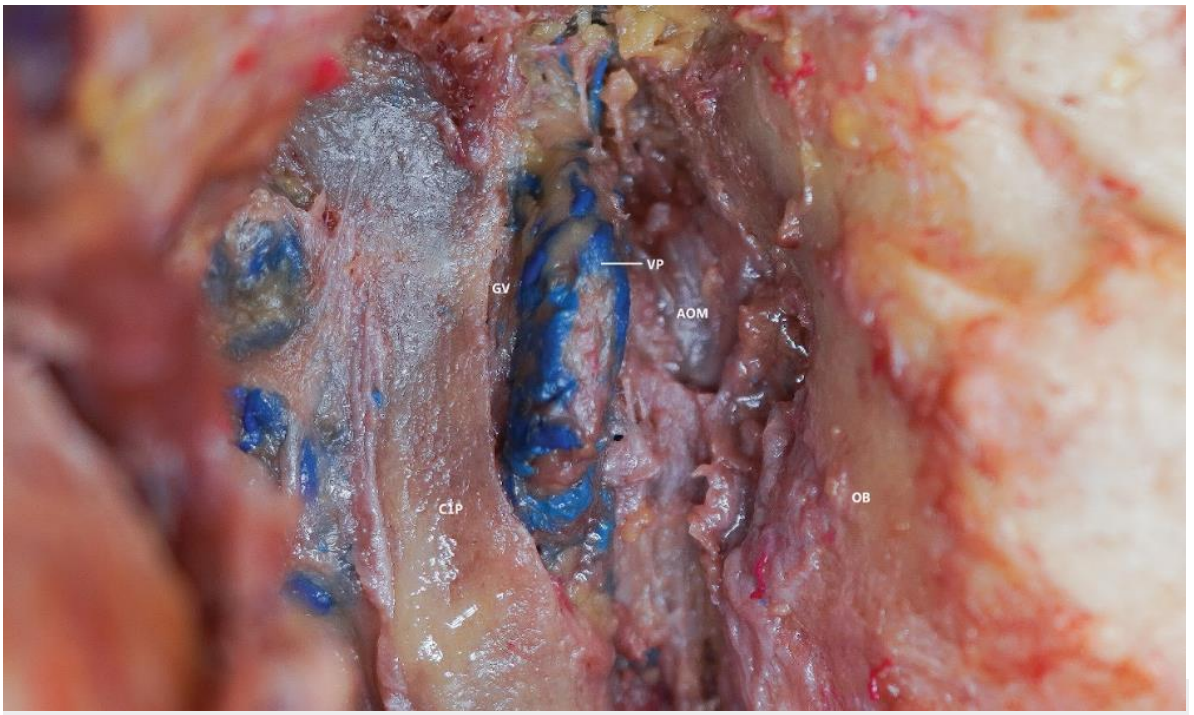


FM = foramen magnum

Ci = Clivus

CF = condylar foramen

OC = occipital condyle

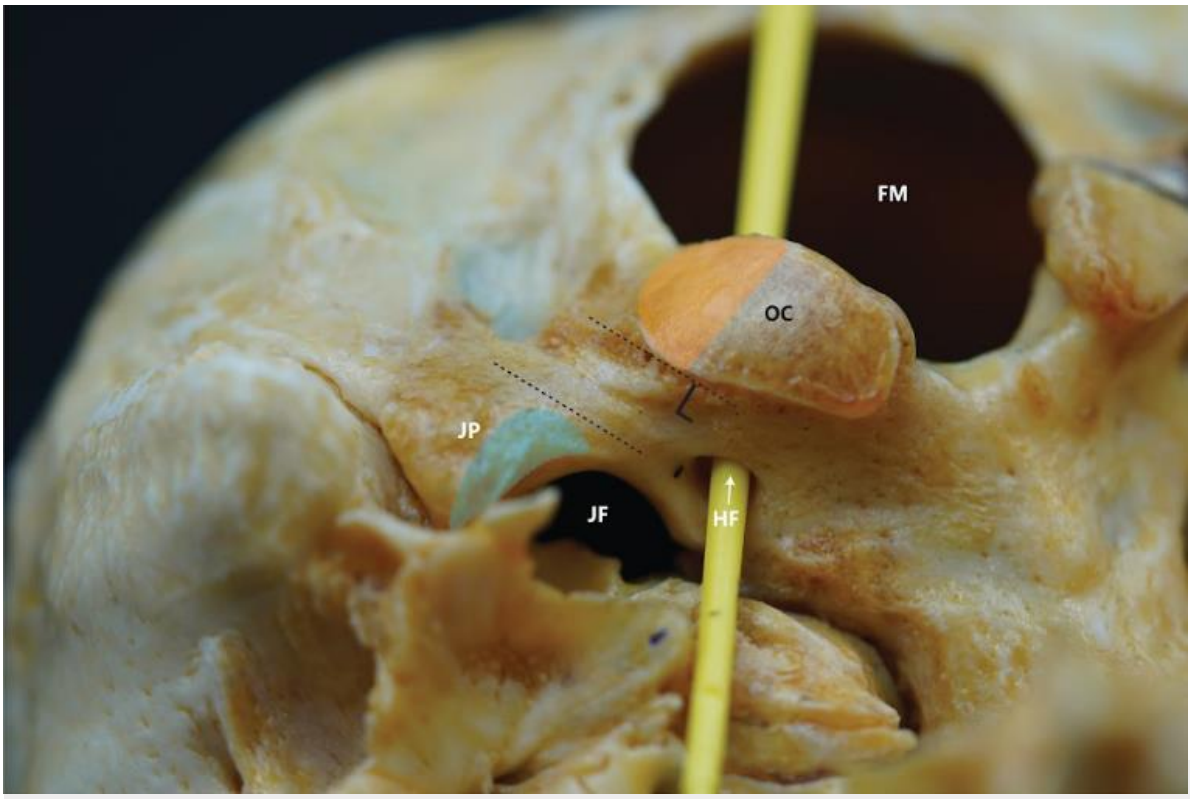


VP = venous plexus covering the vertebral artery

C1P = posterior arch of C1 vertebra

OB = occipital bone

AOM = atlanto-occipital membrane
SA = sulcus arteriosus.



Demonstration of the following:

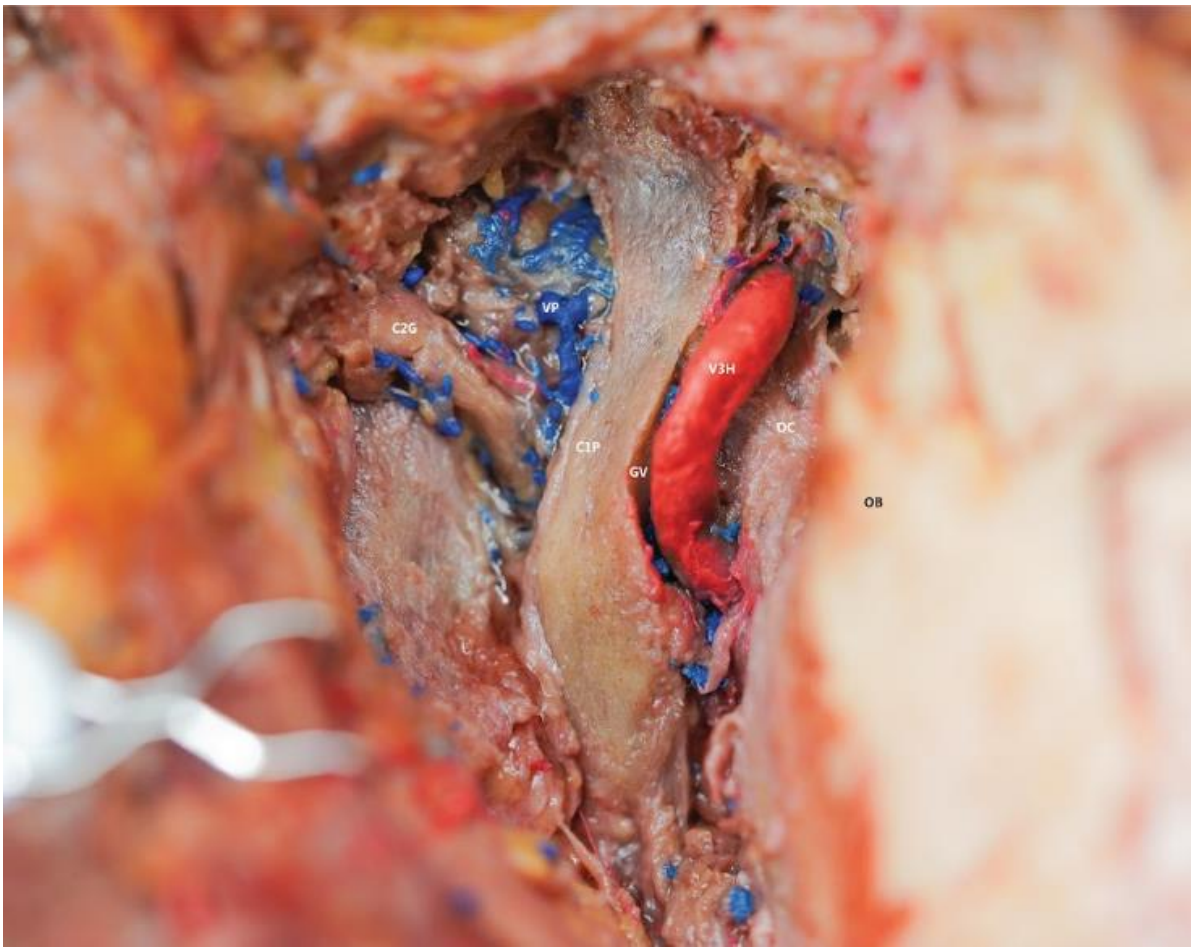
the transcodylar = orange highlight

supracondylar = black dashed line

paracondylar approaches = blue highlight

FM = foramen magnum
JF = jugular Foramen
HF = hypoglossal foramen
OC = occipital condyle
JP = jugular process.

If the posterior one third of the occipital condyle was removed, the anterolateral portion of the foramen magnum will be accessed. If the supracondylar above the hypoglossal canal was drilled the lower lateral edge of the clivus will be exposed. The jugular tubercle can be accessed if the supracondylar portion below the hypoglossal canal was removed. The paracondylar approach gives access to the jugular bulb



Far Lateral Approach

V3H = horizontal branch of vertebral artery

OB = occipital bone

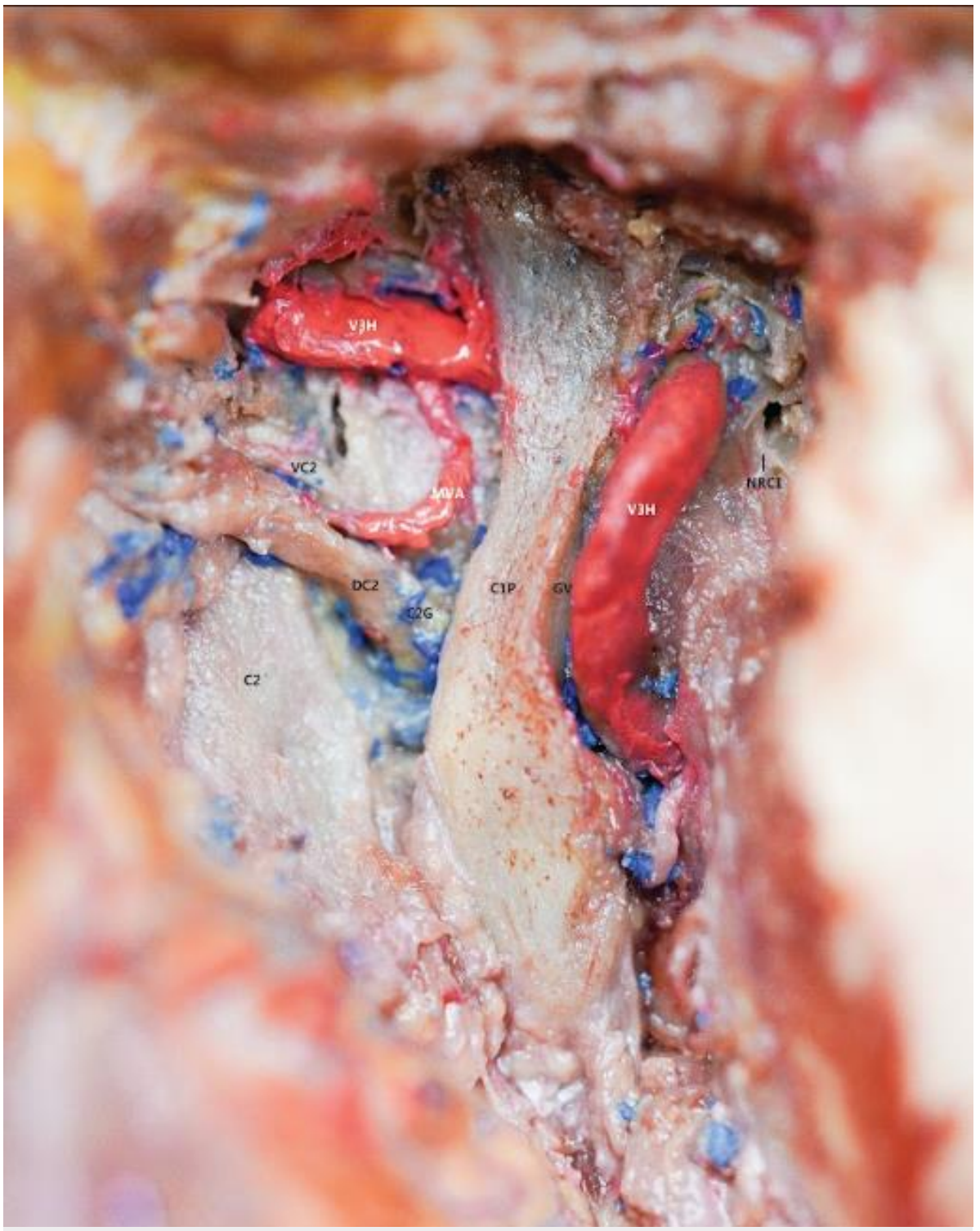
C1P = posterior arch of C1 vertebra

GV = groove of vertebral artery

OC = occipital condyle

C2G = C2 vertebra ganglion

VP = venous plexus



V3H = horizontal branch of vertebral artery

C1P = posterior arch of C1 vertebra

GV = groove of vertebral artery

C2G = C2 vertebra ganglion

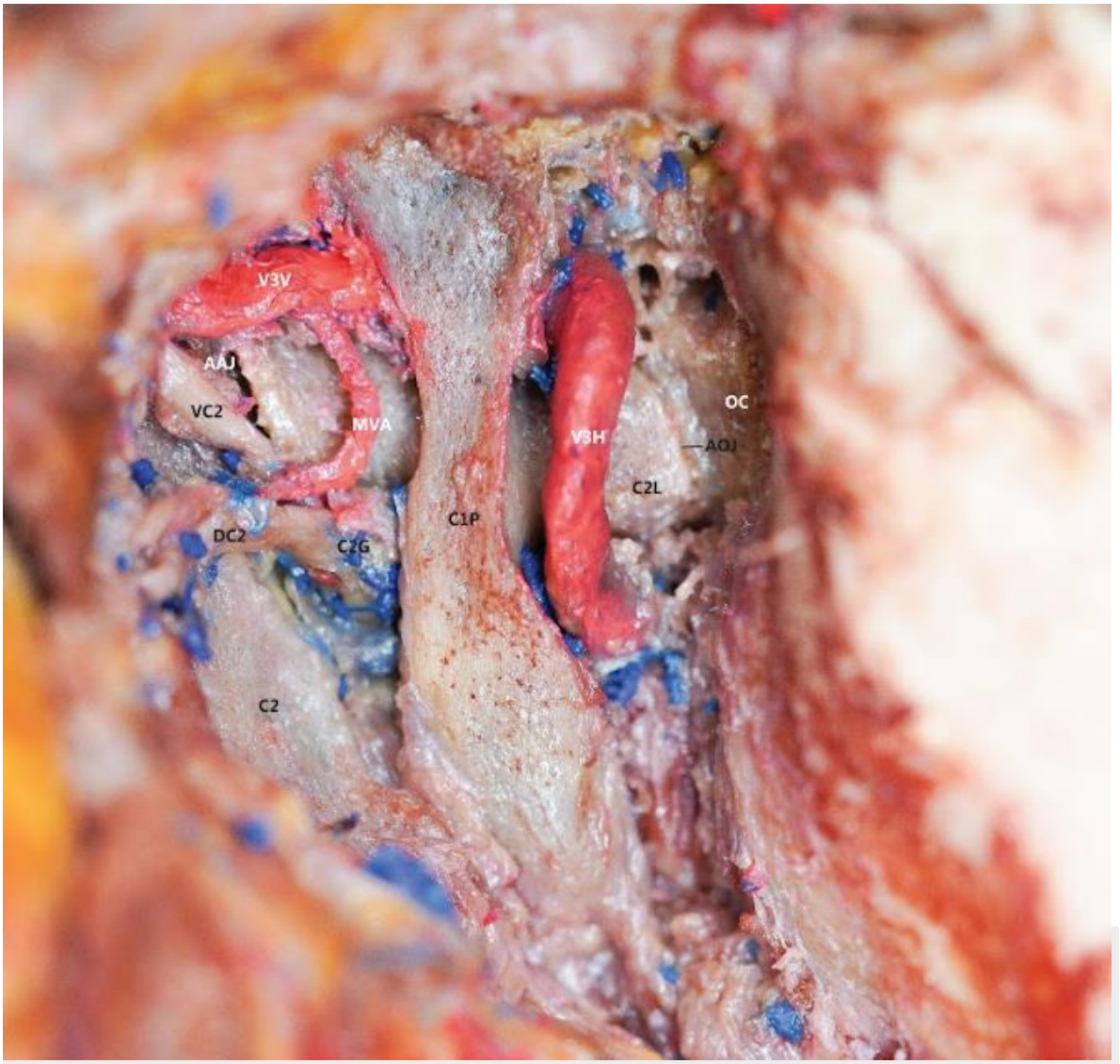
NRC1 = nerve root of C1

DC2 = dorsal ramus of C2

VC2 = ventral ramus of C2

MVA = muscular branch of vertebral artery

C2 = C2 vertebra



V3H = horizontal branch of vertebral artery

C1P = posterior arch of C1 vertebra

C2G = C2 vertebra ganglion

DC2 = dorsal ramus of C2

VC2 = ventral ramus of C2

MVA = muscular branch of vertebral artery

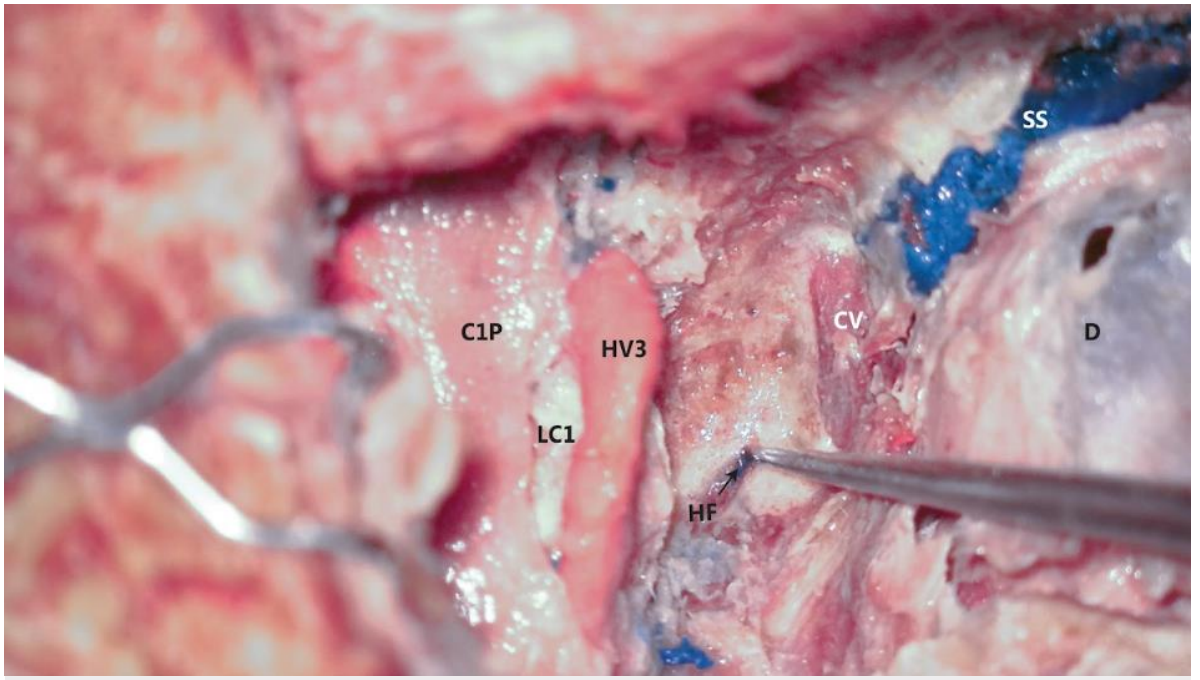
C2 = C2 vertebra

OC = occipital condyle

C2L = lateral mass of C2

AAJ = atlantoaxial joint

AOJ = atlantooccipital joint



Exposure of the hypoglossal canal.

V3H = horizontal branch of vertebral artery

HF = Hypoglossal foramen

SS = sigmoid sinus

CV = condylur vein

D = dura matter

C1P = posterior arch of C1 vertebra

LC1 = lateral mass of C1 vertebra

CF = condylar foramen

V3H = horizontal segment of vertebral artery

C1P = posterior arch of C1 vertebra

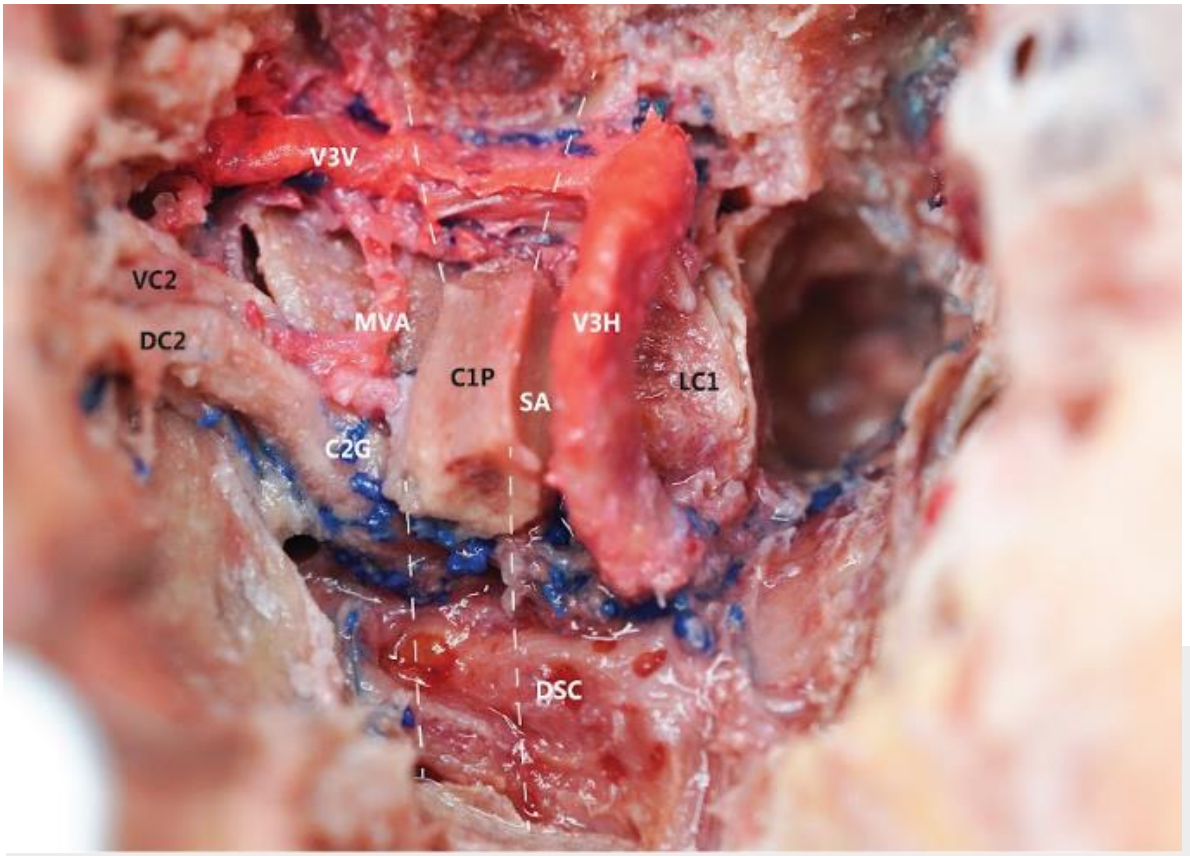
SA = sulcus arteriosus

MVA = muscular branch of vertebral artery

V3V = vertical segment of vertebral artery

LC1 = lateral mass of C1 vertebra

Posterior one third of the condyle was removed, represented by white dashed line



C1 laminectomy was performed and posterior process of the transverse foramen was removed.

V3H = horizontal segment of vertebral artery

C1P = posterior arch of C1 vertebra

SA = sulcus arteriosus

MVA = muscular branch of vertebral artery

V3V = vertical segment of vertebral artery

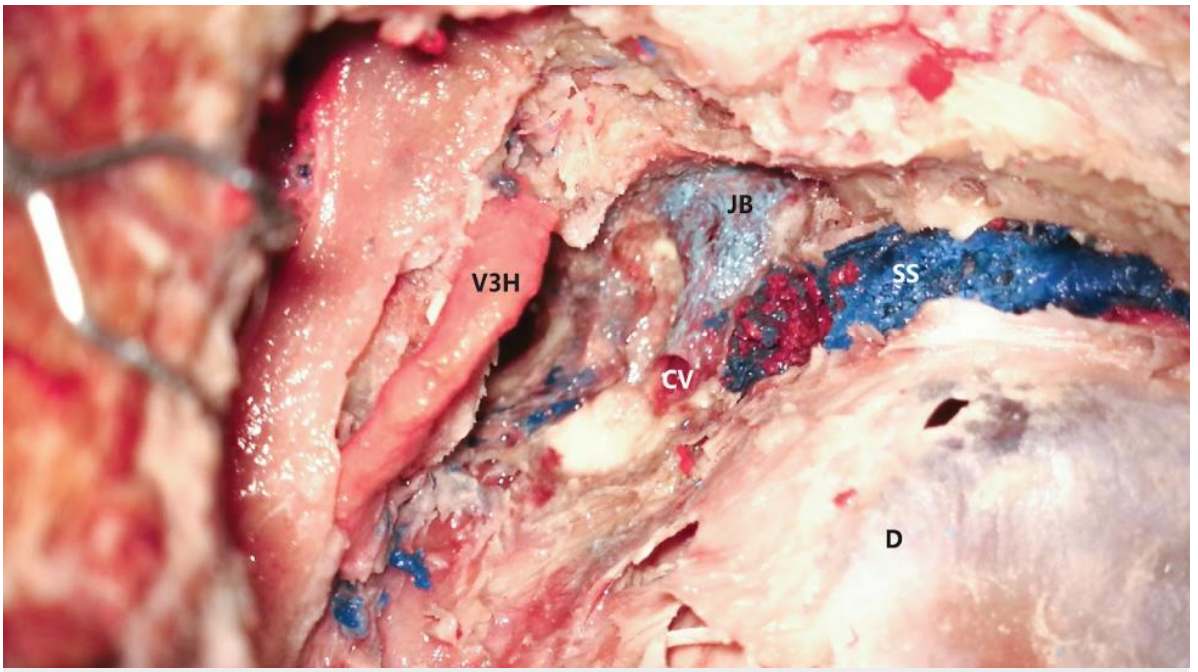
LC1 = lateral mass of C1 vertebra

DC2 = dorsal ramus of C2

VC2 = ventral ramus of C2

C2G = C2 vertebra ganglion

DSC = dura matter of spinal cord



Demonstration of the communication between the sigmoid sinus, jugular bulb, and condylar vein.

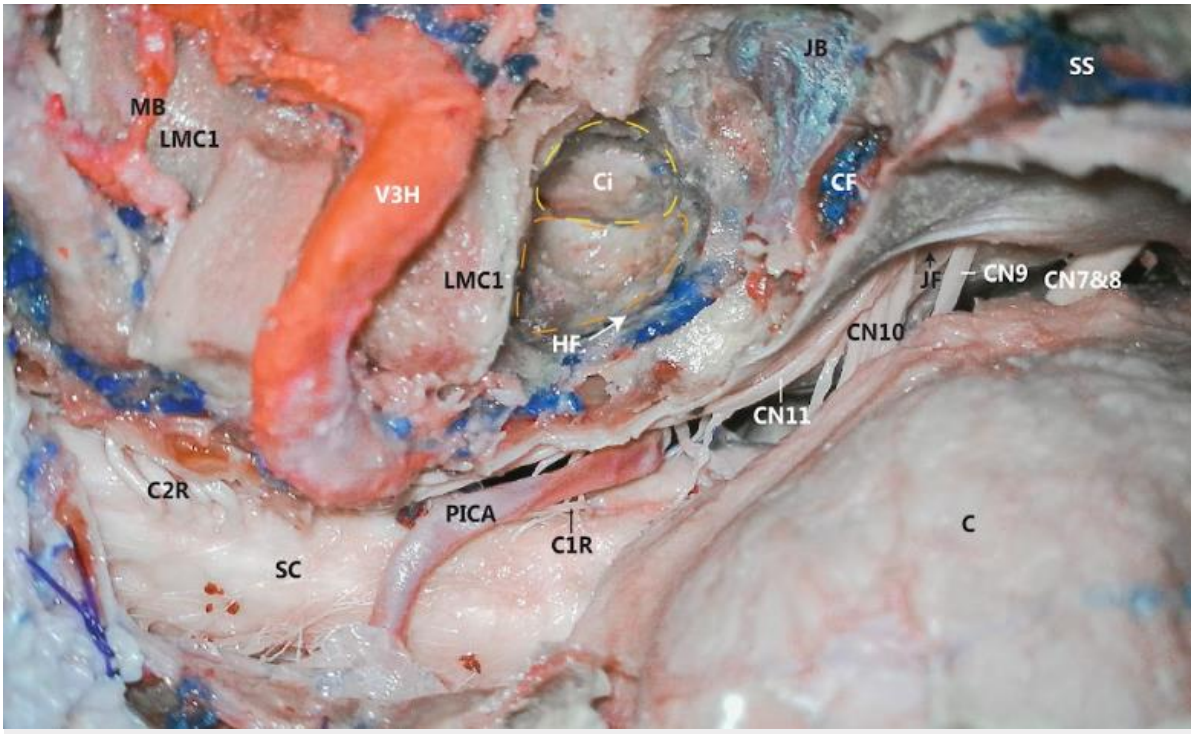
D = dura matter

SS = sigmoid sinus

V3H = horizontal segment of vertebral artery

CV = condylar vein

JB = jugular bulb



Intradural exposure of the far lateral approach with supracondylar exposure (orange dashed lines) of the clivus (yellow dashed lines) and jugular bulb.

V3H = vertebral artery horizontal segment

LMC1 = lateral mass of C1 vertebra

Ci = clivus

HF = hypoglossal foramen

CF = condylar foramen

JB = jugular bulb

SS = sigmoid sinus

Orange dashed line = supracondylar exposure below hypoglossal canal

PICA = posterior inferior cerebellar artery anterior and lateral medullary segments

CN 9 = glossopharyngeal nerve

CN 7 & 8 = vestibulocochlear and facial nerve complex

C2R = C2 rootlets

SC = spinal cord

C1R = C1 rootlets

JF = jugular foramen

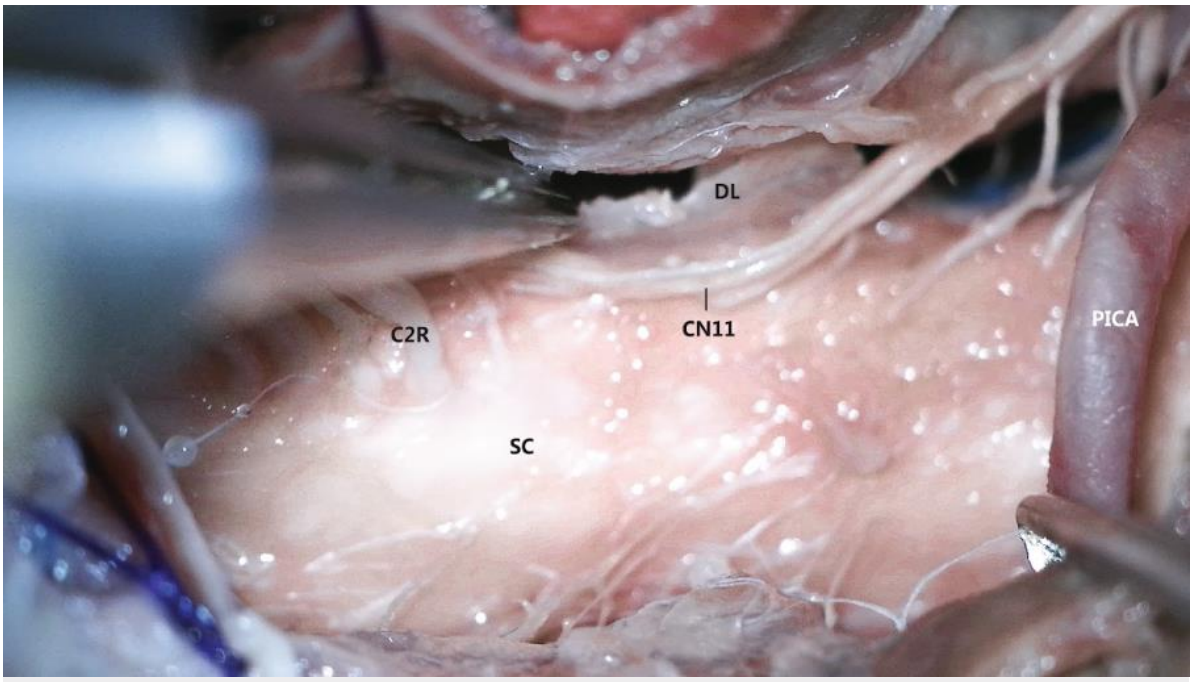
CN 11 = spinal accessory nerve

CN 10 = vagus nerve

C = cerebellum

MB = muscular branch

Black dashed line demonstrates the removed posterior process of C1



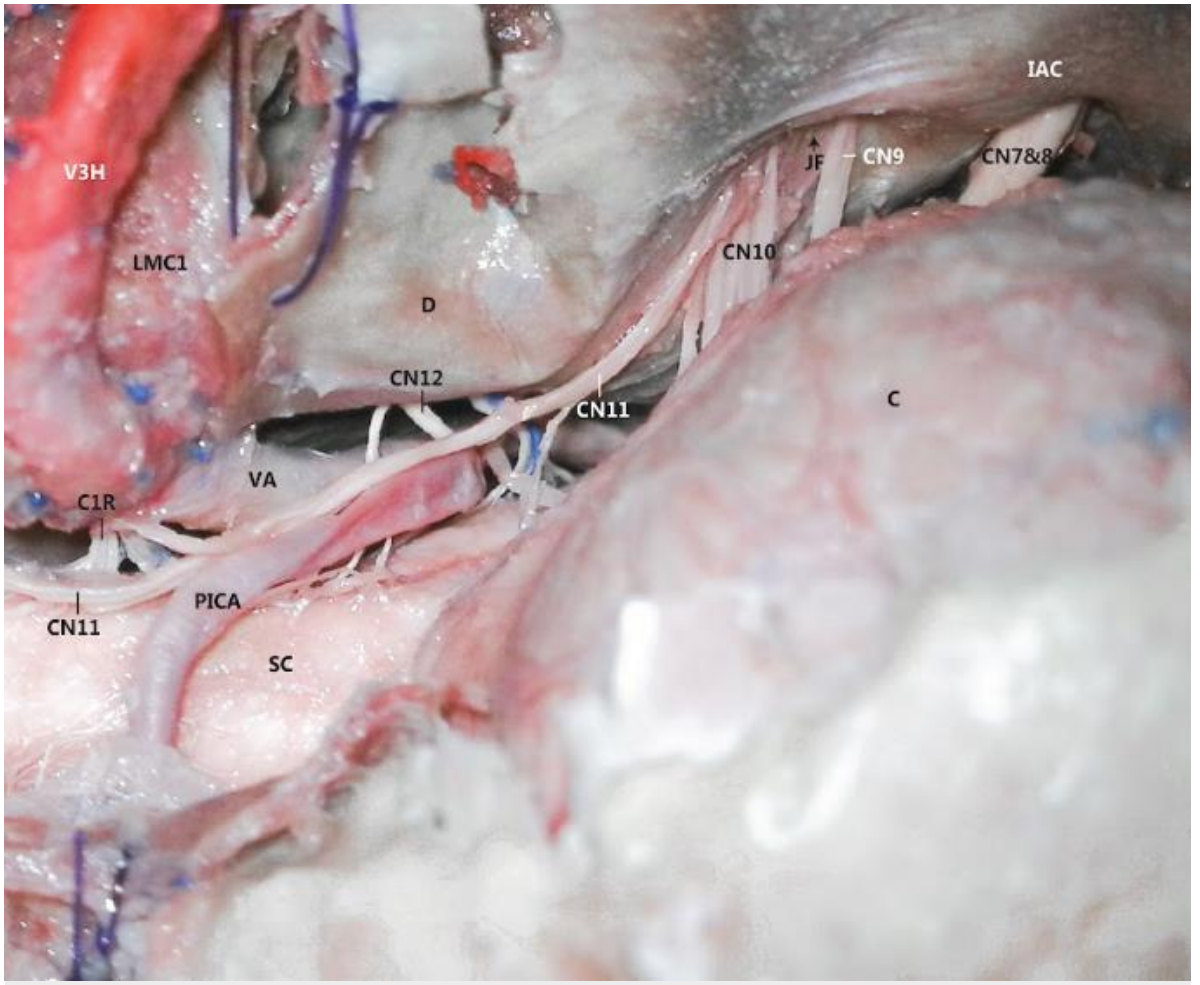
Intradural exposure of Far-Lateral approach

C2R = C2 Rootlets

SC = spinal cord

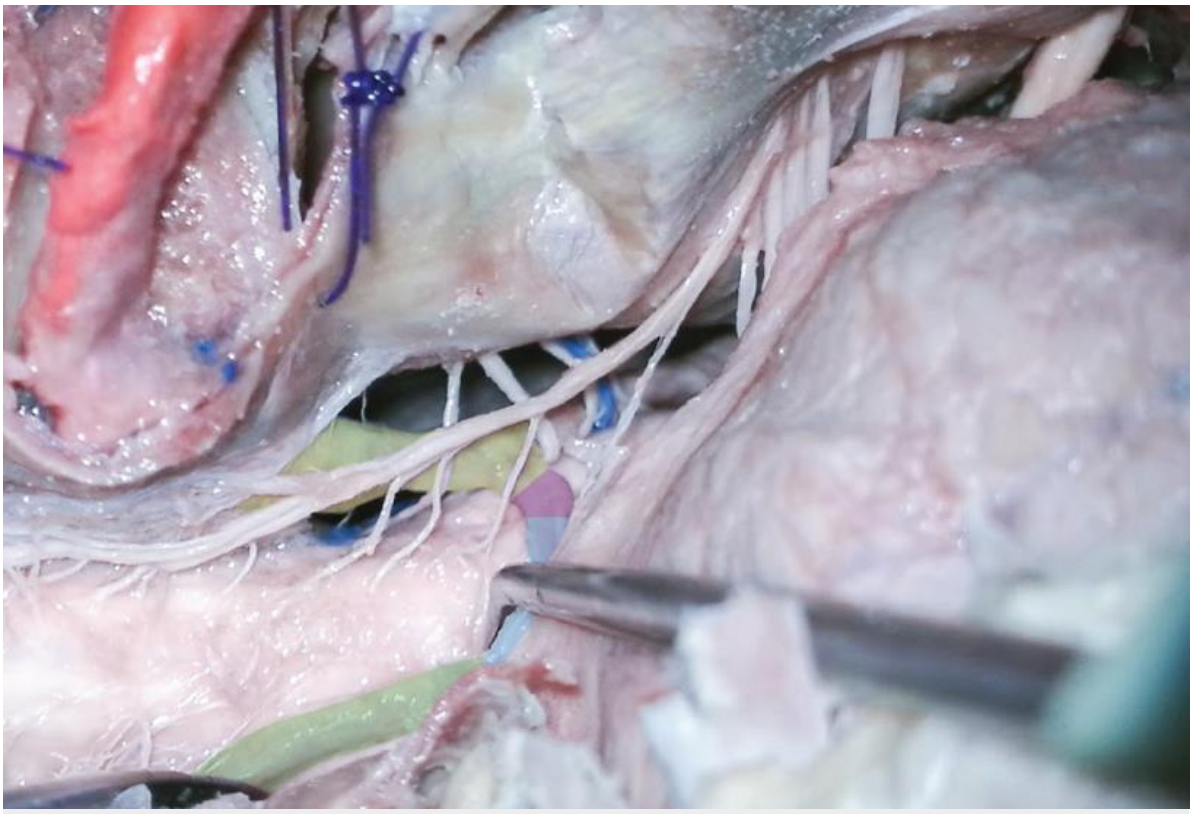
CN 11 = spinal accessory nerve

PICA = posterior inferior cerebellar artery



Intradural exposure of far lateral approach

V3H = vertebral artery horizontal segment
LMC1 = lateral mass of C1 vertebra
IAC = internal auditory canal
PICA = posterior inferior cerebellar artery
JF = jugular foramen
CN 11 = spinal accessory nerve
CN 10 = vagus nerve
CN 9 = glossopharyngeal nerve
CN 7 & 8 = vestibulocochlear and facial nerve complex
C = cerebellum
SC = spinal cord
D = dura mater
C1R = C1 rootlets



Intradural exposure of far lateral approach

Purple shaded area = anterior medullary segment of PICA

lue shaded area = lateral medullary segment of PICA

Green shaded area = tonsillomedullary segment of PICA

Yellow shaded area = intradural segment of vertebral artery

Patient positioning: supine with neck slightly extended. Skin incision: 3-5 cm oblique over the skin crease.

LSI = lateral margin of the skin Incision
TSI = transverse skin incision.

MI = midline at the level of thyroid cartilage (medial margin of skin incision)
ASCM = anteriorborder of sternocleidomastoid
DL = distance to lateral incision

Subcutaneous dissection & platysma muscle exposure.

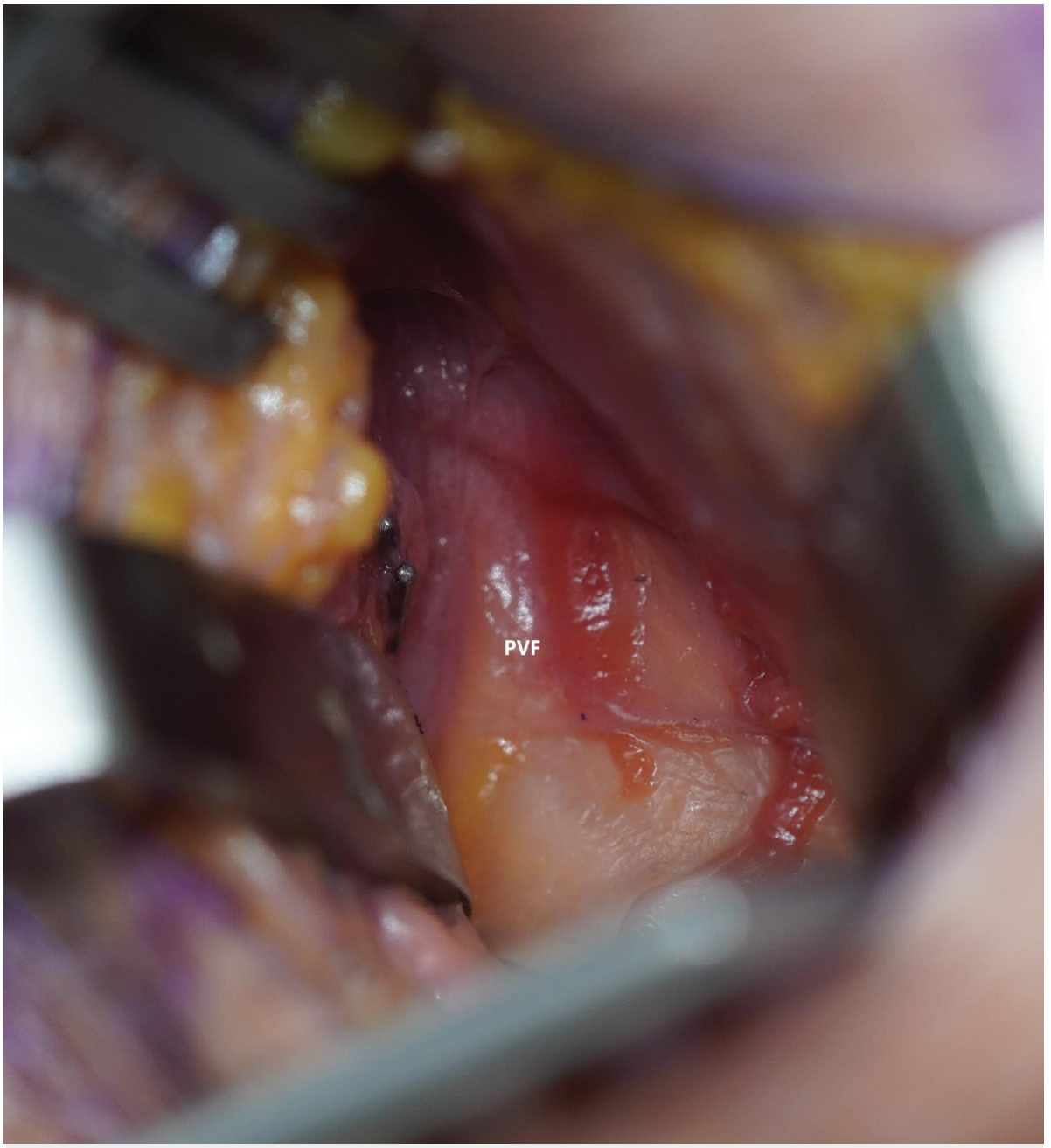
PyM = Platysma muscle
SC = subcutaneous tissue

Anterior cervical discectomy of C5-C6. Platysma muscle incision & retraction.

Asterisk = fascia covering the platysma muscle.

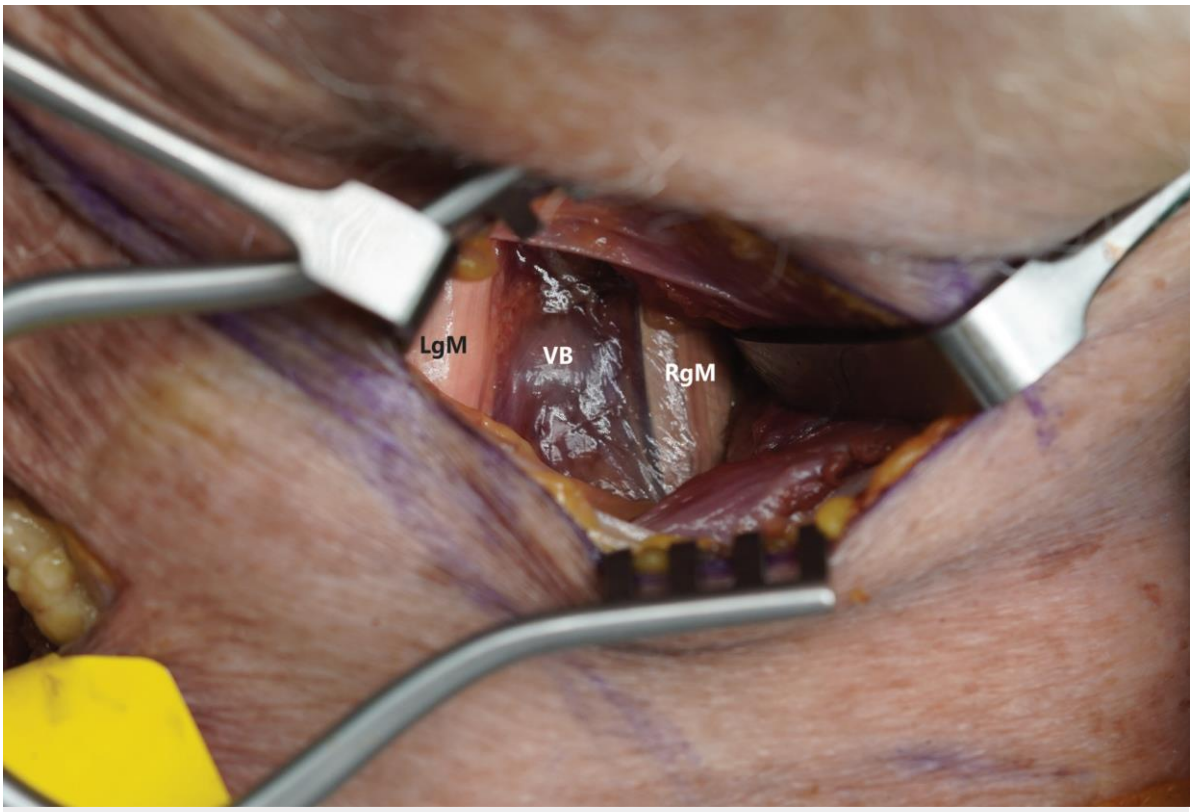
Sharp dissection in the plane between the sternocleidomastoid and omohyoid muscle.

SCM = sternocleidomastoid muscle
OhM = omohyoid muscle
White arrow = shows the plane of dissection.

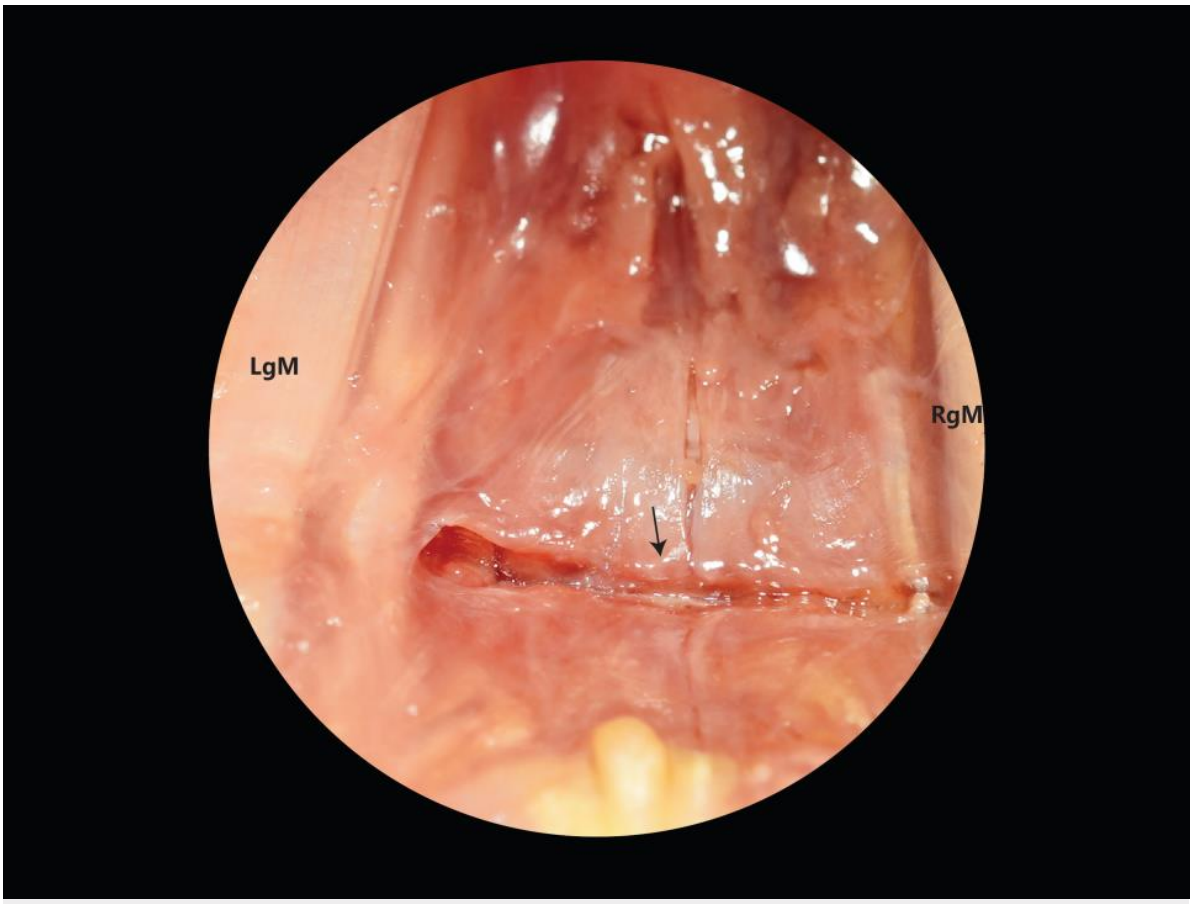


Carotid sheath (carotid artery, jugular vein, vagus nerve) retracted laterally, trachea and esophagus retracted medially.

PVF = paravertebral fascia.

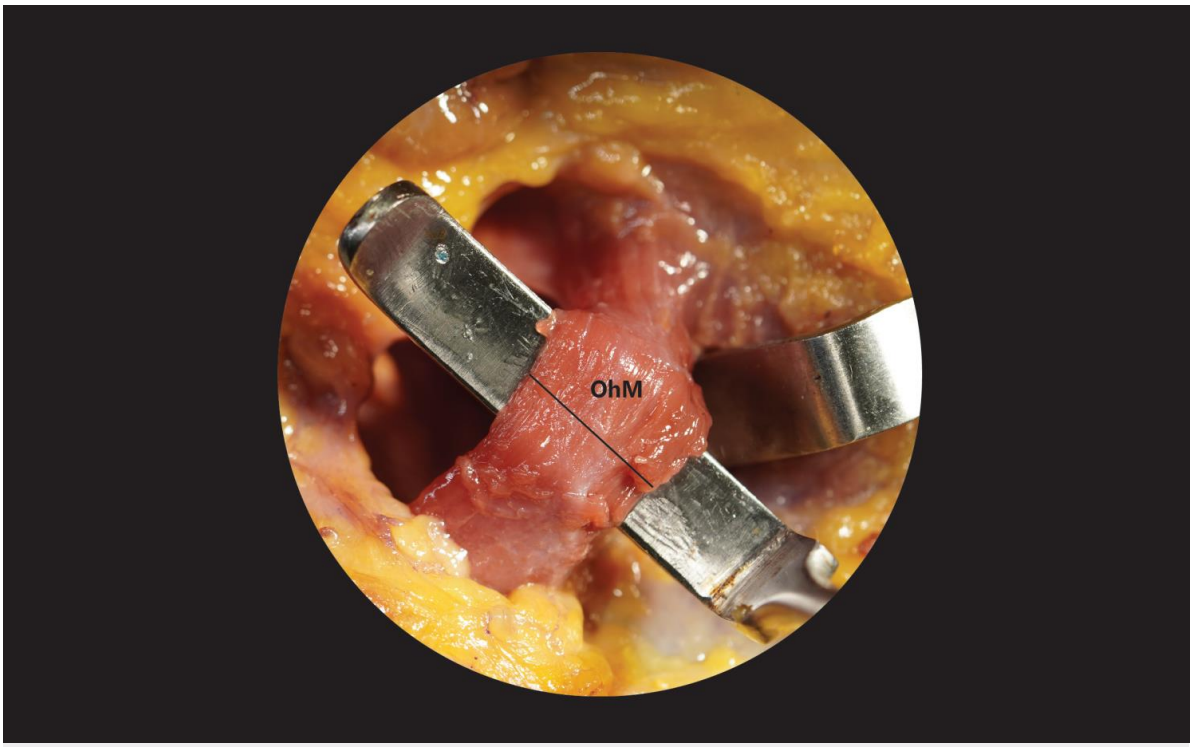


RgM = right longus colli muscle
LgM = left longus colli muscle
VB = vertebral body.

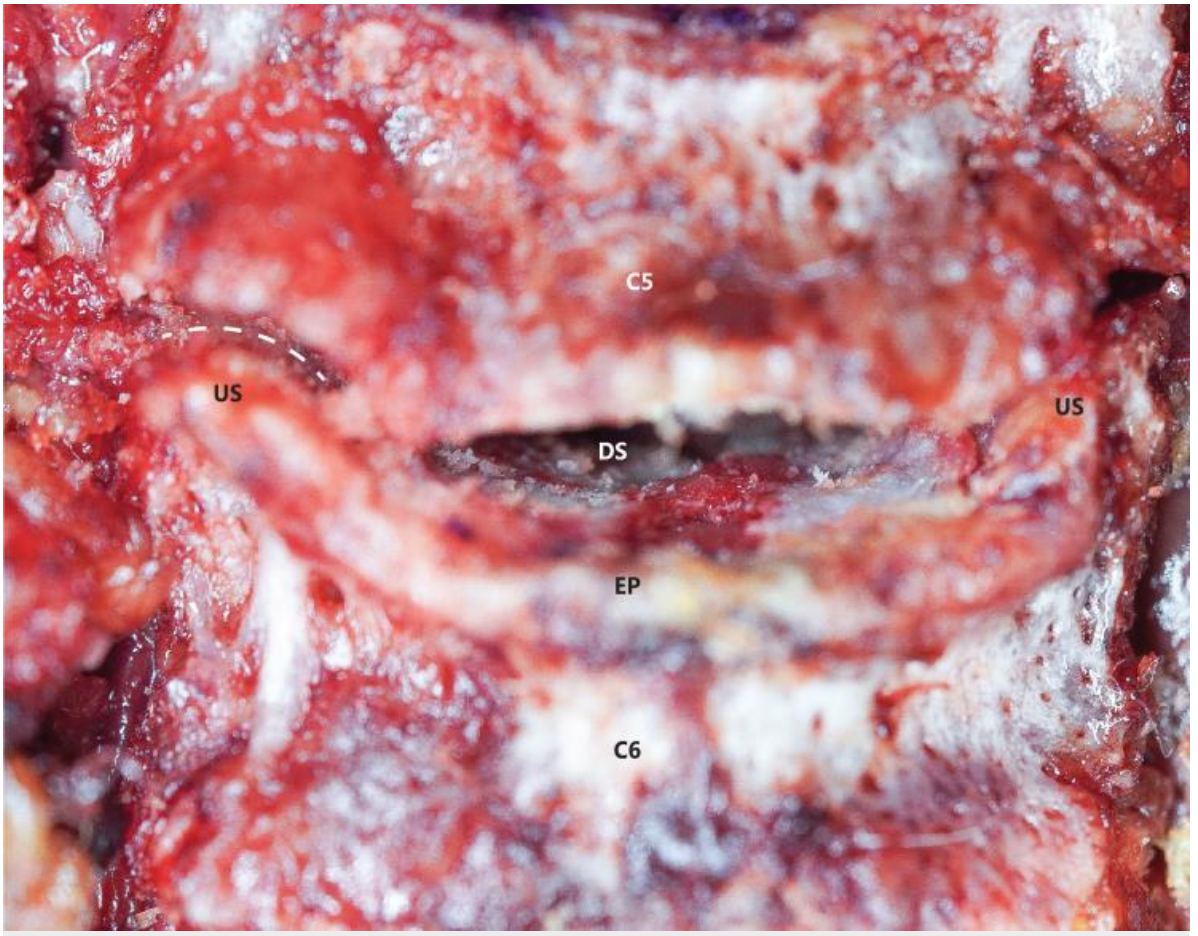


Anterior longitudinal Ligament (ALL) incision at the C5-C6 intervertebral space.

RgM = right longus colli muscle
LgM = left longus colli muscle.

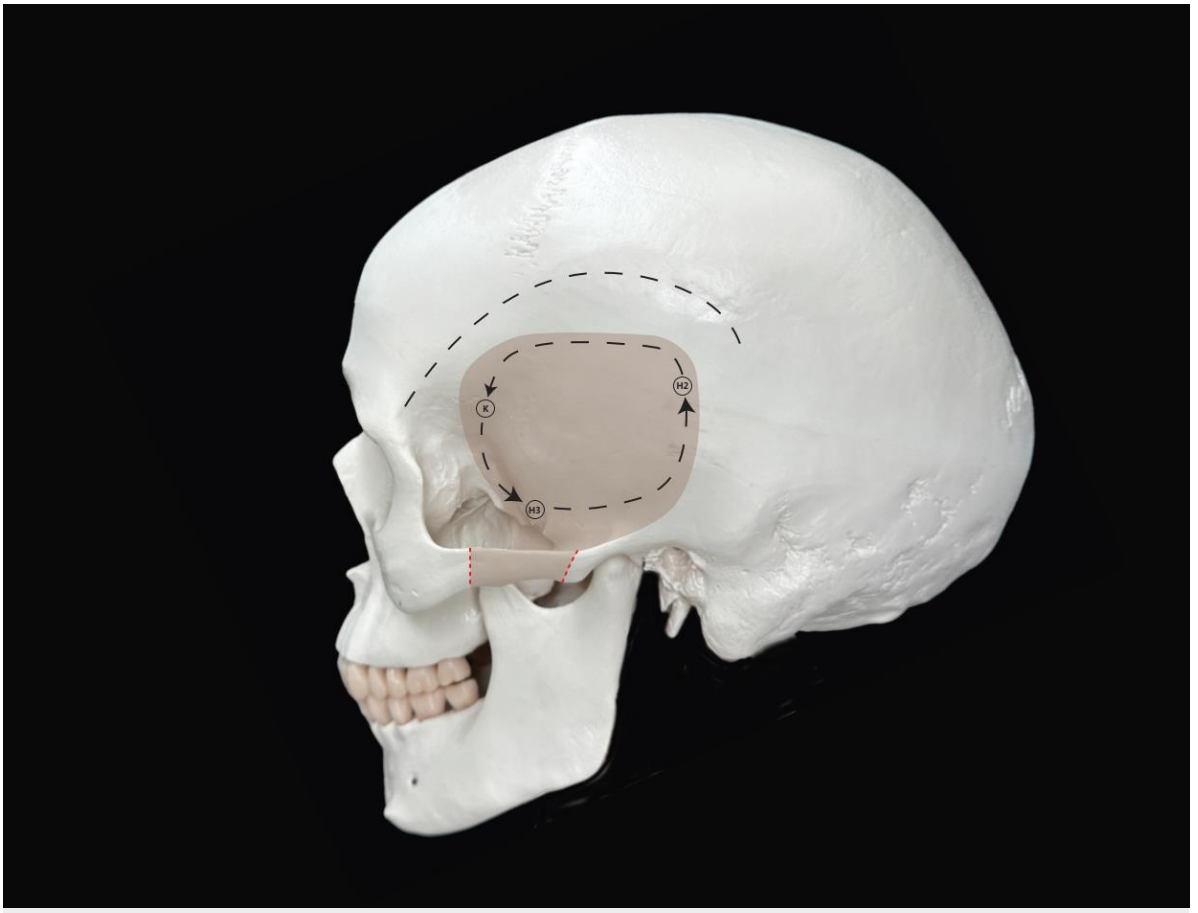


Omohyoid muscle (OhM) can be isolated and cutted for further expouser as demonstrated.



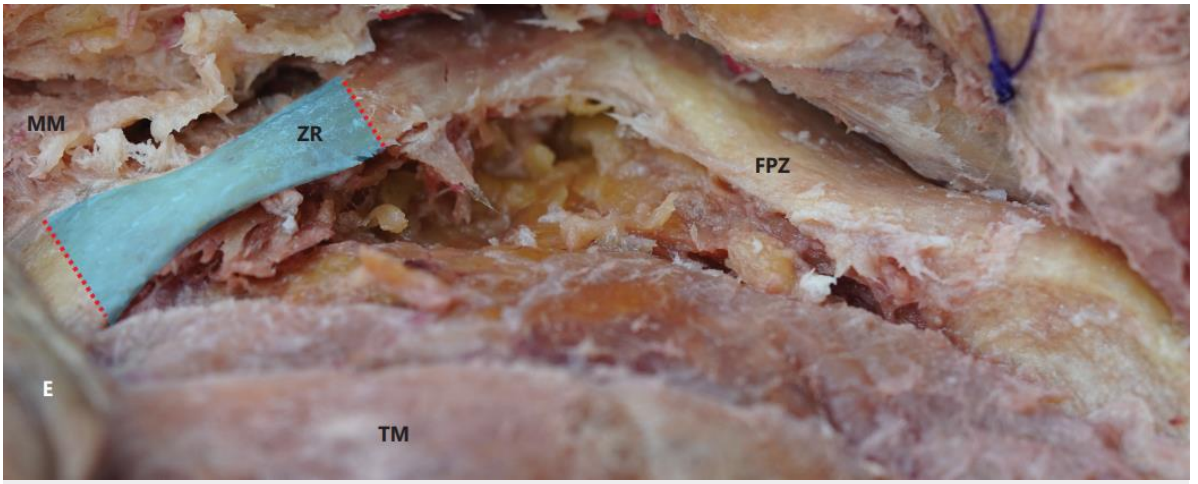
The disc is meticulously removed and cleaned out from the intervertebral space, including the posterior longitudinal ligament if necessary.

DS = intravertebral disc space
C5 = C5 vertebra
C6 = C6 vertebra
US = uncinate process
EP = end plate of C6
White dashed line = Luschka's joint.



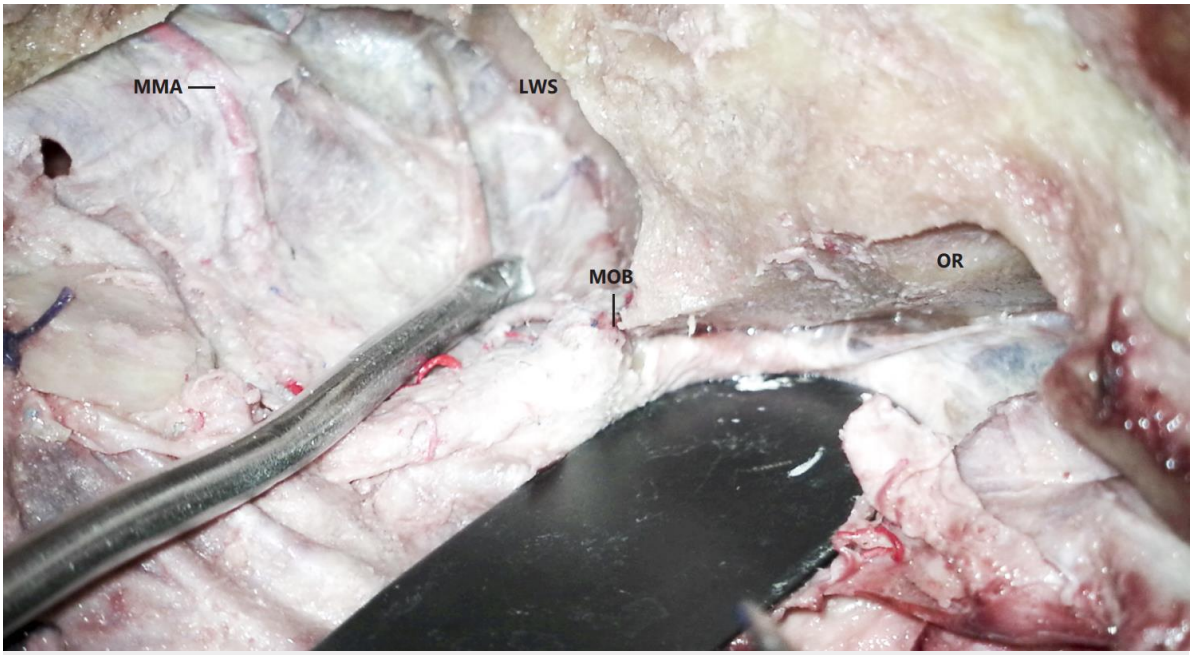
Craniotomy - skull module

K = keyhole
H2 = second burr hole
Red dashed line = zygomatic cutting
H3 = third burr hole



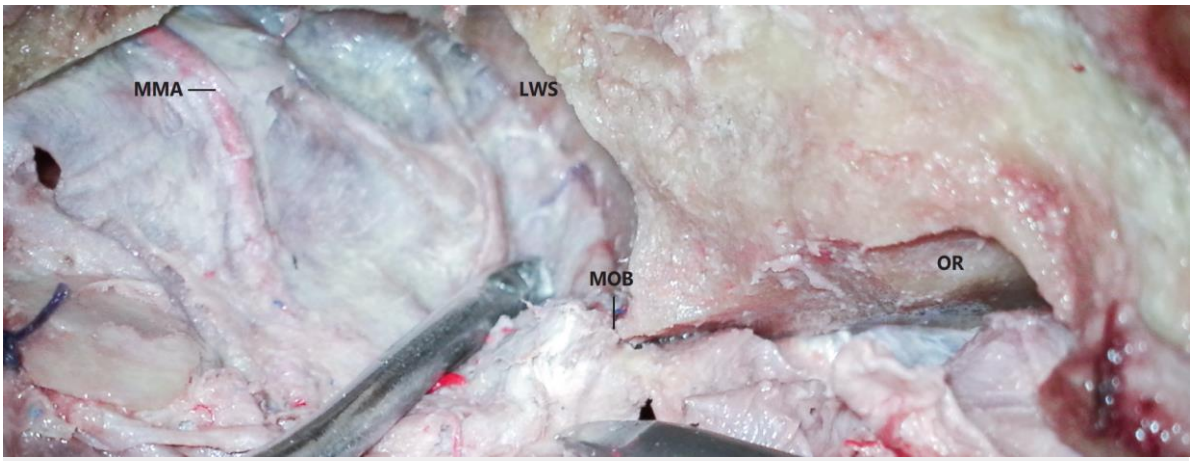
Zygomatic osteotomy location.

TM = temporalis muscle
MM = masseter muscle
ZR = zygomatic root
FPZ = frontal process of zygoma
E = ear



Extradural anterior clinoidectomy.
Orbitotemporal periosteal dissection and superior orbital fissure exposure.
Note the exposed vascular bundle of the meningo-orbital band

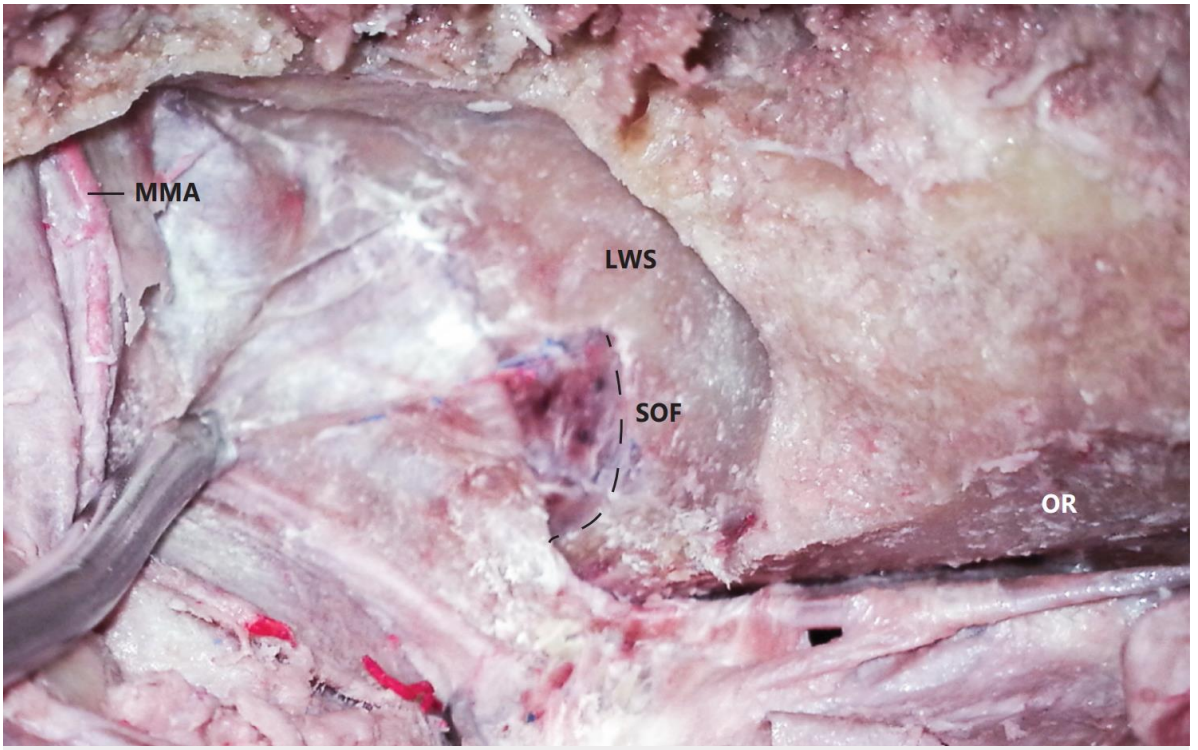
OR = orbital roof
LWS = lesser wing of sphenoid
MOB = meningo-orbital band with the vascular bundle
MMA = middle meningeal artery



Extradural anterior clinodectomy.
I. orbitotemporal periosteal dissection and release of the meningo-orbital band and superior orbital ssure exposure.

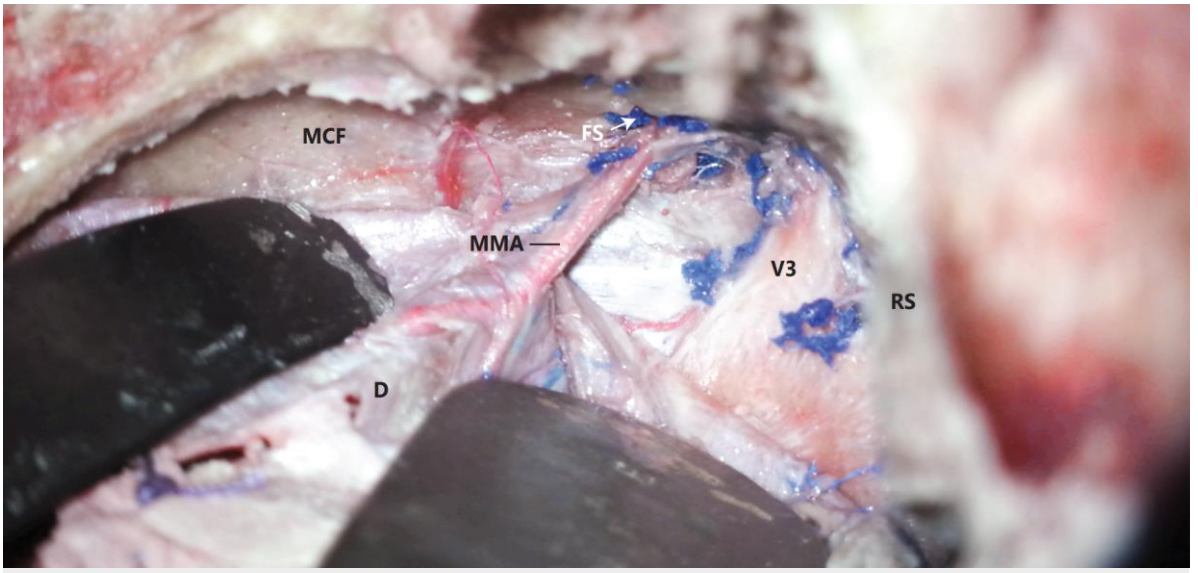
OR = orbital roof
LWS = lesser wing of sphenoid
MOB = meningo-orbital band with the vascular bundle
MMA = middle meningeal artery

05, June 2024



Extradural anterior clinoidectomy.
II. Orbitotemporal periosteal dissection and superior orbital fissure exposure

OR = orbital roof
LWS = lesser wing of sphenoid
SOF = superior orbital fissure
MMA = middle meningeal artery



Extradural anterior clinoidectomy.
Orbitotemporal periosteal dissection.

D = dura matter overlying lateral wall of cavernous sinus

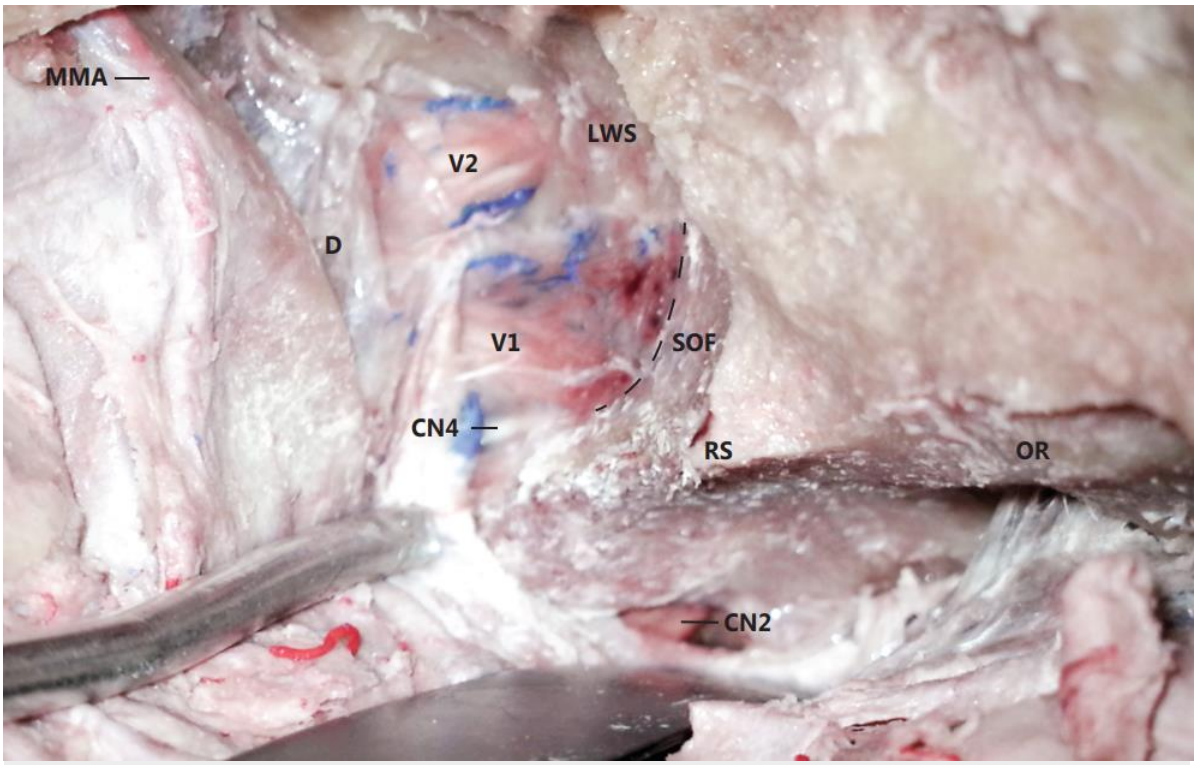
MCF = middle cranial fossa

V3 = mandibular branch of trigeminal schwannoma

RS = ridge of sphenoid

MMA = middle meningeal artery

FS = foramen spinosum



Extradural anterior clinoidectomy.
III. Orbitotemporal periosteal dissection and optic canal exposure.

SOF = superior orbital fissure

D = dura matter overlying lateral wall of cavernous sinus

V1 = ophthalmic branch of the trigeminal nerve

V2 = maxillary branch of the trigeminal nerve

CN 4 = trochlear nerve

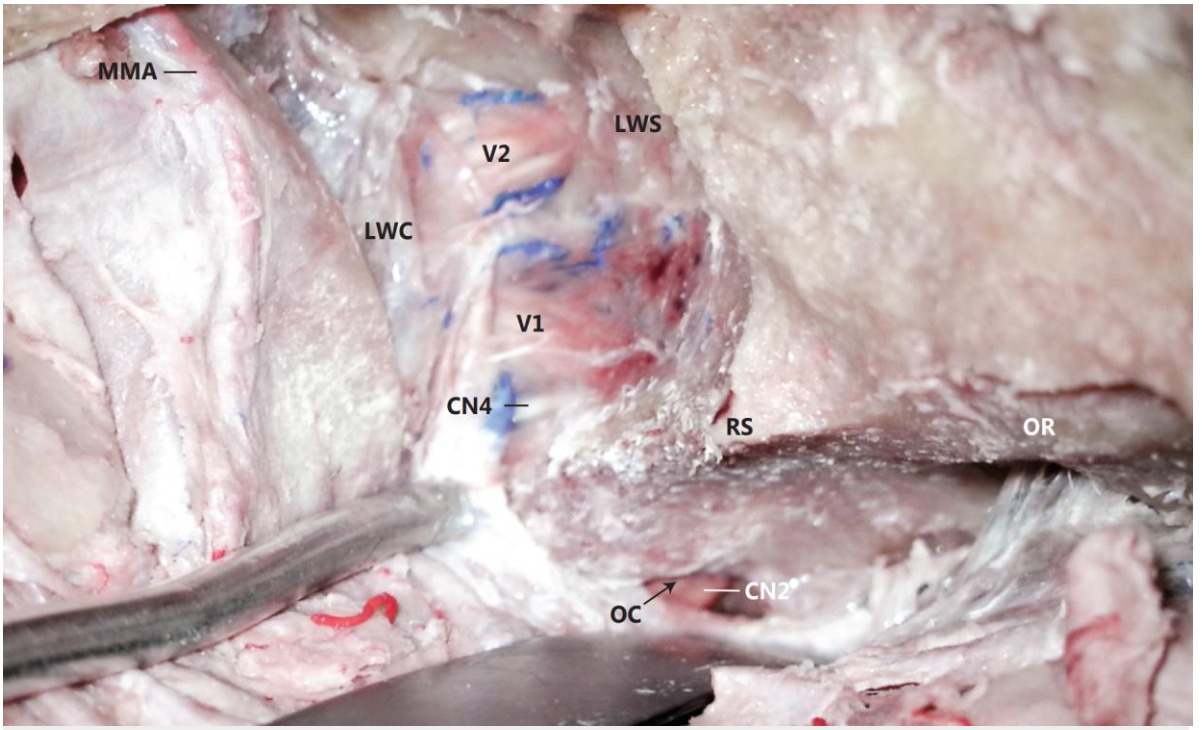
CN2 = optic nerve

OR = orbital roof

LWS = lesser wing of sphenoid

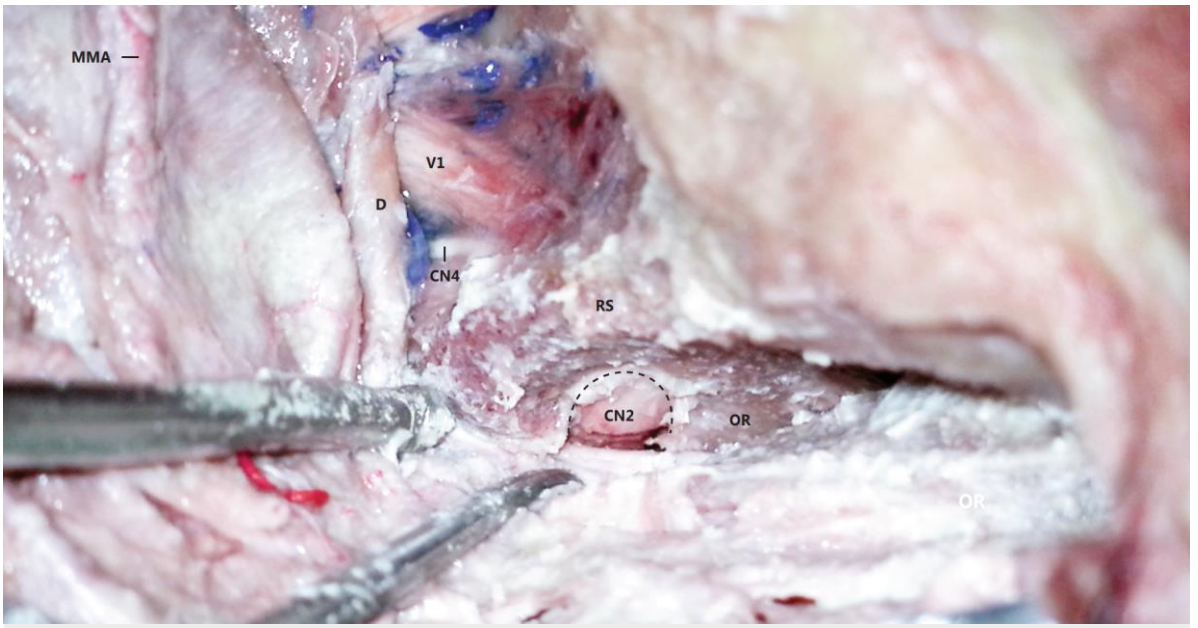
RS = ridge of sphenoid

MMA = middle meningeal artery



Extradural anterior clinoidectomy.
III. Orbitotemporal periosteal dissection and optic canal exposure.

LWS = lesser wing of sphenoid
RS = ridge of sphenoid
MMA = middle meningeal artery
V1 = ophthalmic branch of the trigeminal nerve
V2 = maxillary branch of the trigeminal nerve
CN 4 = trochlear nerve
CN2 = optic nerve
OR = orbital roof
D = dura matter overlying lateral wall of cavernous sinus
SOF = superior orbital fissure
OC = optical canal



Extradural anterior clinoidectomy.
IV. Enroofing of the optic canal.

V1 = ophthalmic branch of the trigeminal nerve

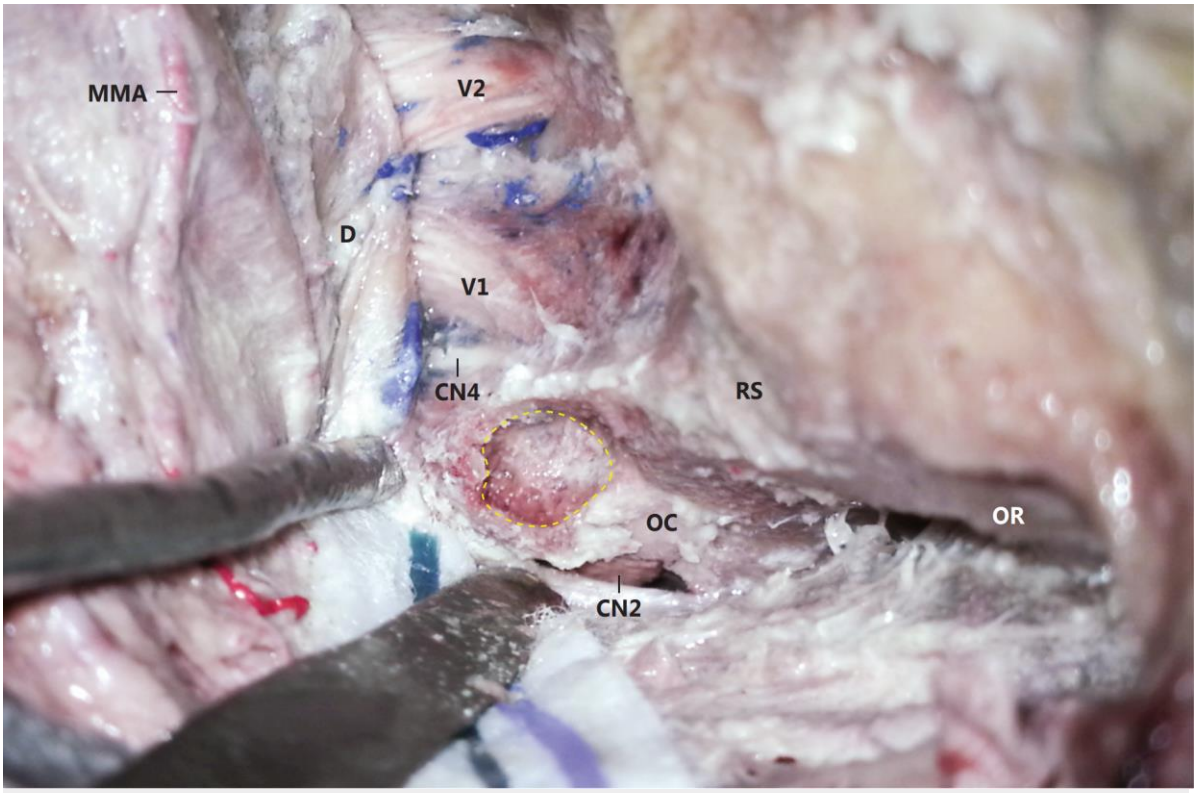
CN4 = trochlear nerve

RS = ridge of sphenoid

MMA = middle meningeal artery

D = dura matter overlying lateral wall of cavernous sinus

CN2 = optic nerve



Extradural anterior clinoidectomy.
V. Drilling of the base of anterior clinoid.

OC = optic canal

Black dashed line = foramen rotondum

V1 = ophthalmic branch of the trigeminal nerve

V2 = maxillary branch of the trigeminal nerve

CN 4 = trochlear nerve

CN2 = optic nerve

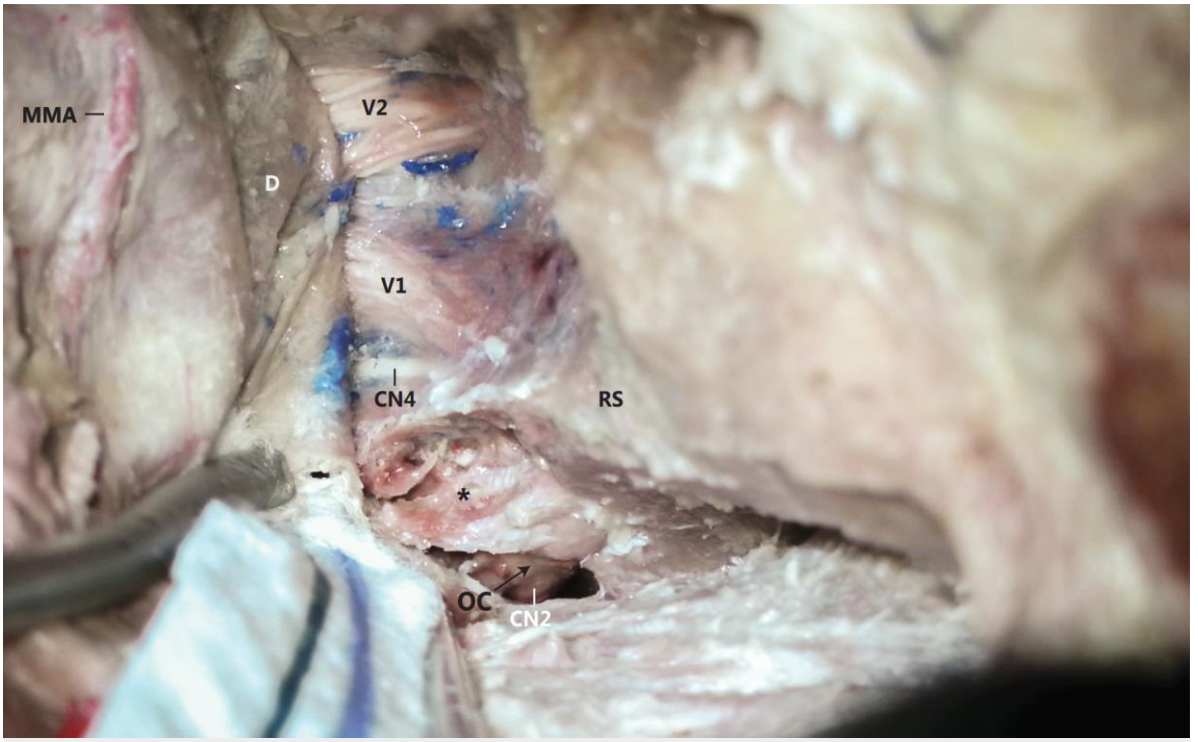
OR = orbital roof

RS = ridge of sphenoid

MMA = middle meningeal artery

D = dura matter overlying lateral wall of cavernous sinus

Yellow dashed line = drilling of anterior clinoid process



Extradural anterior clinoidectomy.
VI. Coring of the clinoid = asterisk

V1 = ophthalmic branch of the trigeminal nerve

V2 = maxillary branch of the trigeminal nerve

OC = optic canal

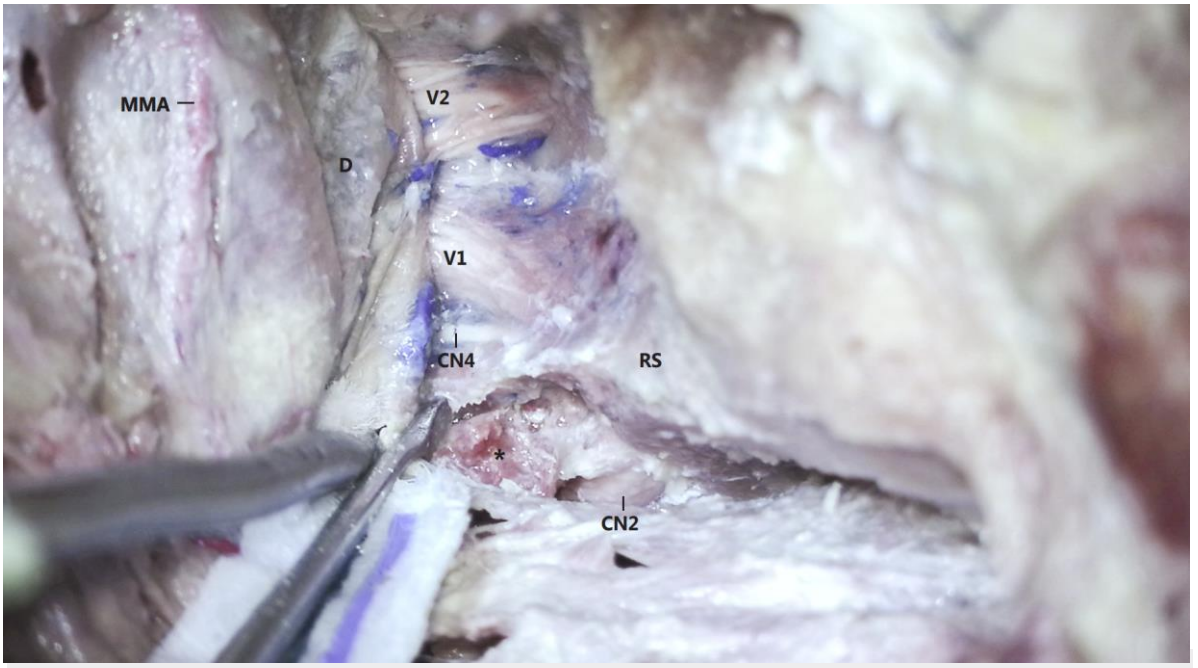
RS = ridge of sphenoid

MMA = middle meningeal artery

D = dura matter overlying lateral wall of cavernous sinus

CN 4 = trochlear nerve

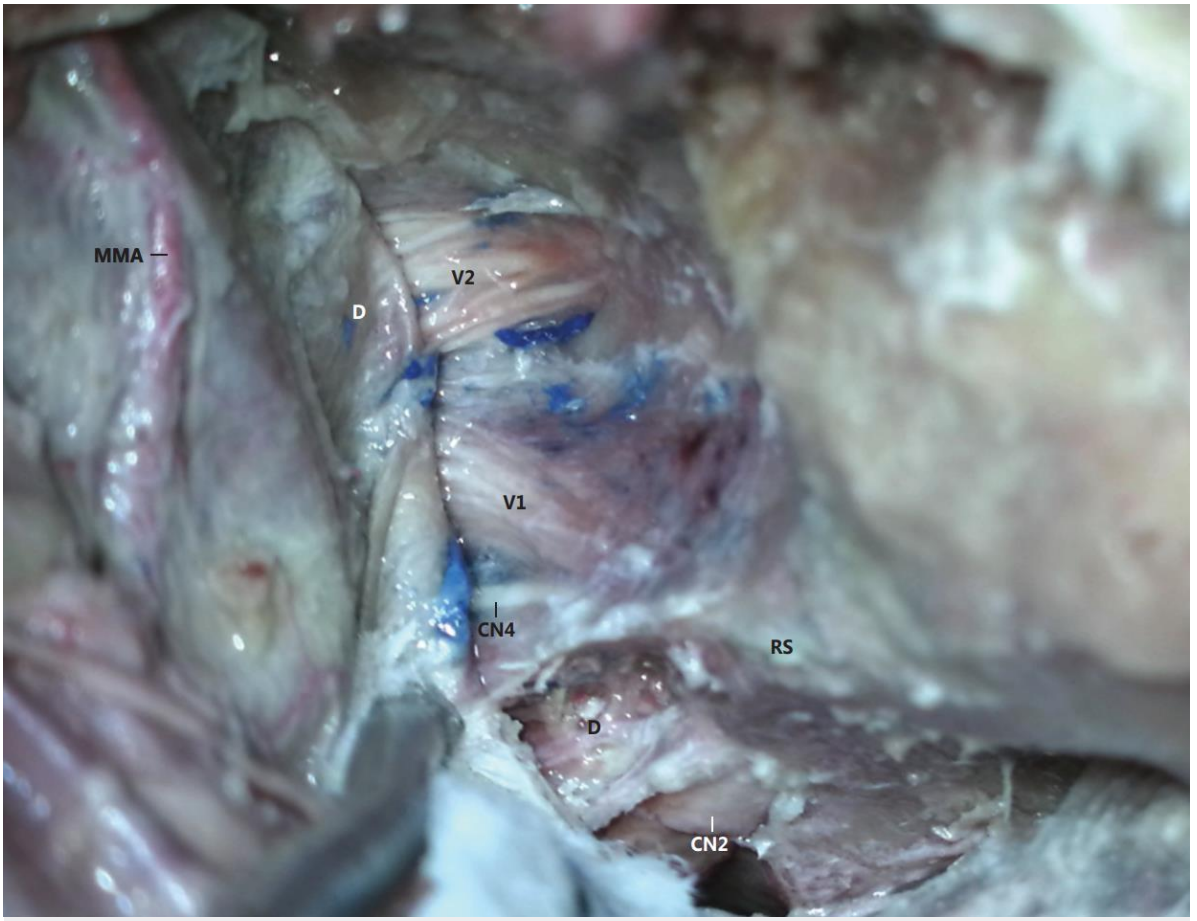
CN2 = optic nerve



Extradural anterior clinoidectomy.
VII. Dissection of bone shell = asterisk

V1 = ophthalmic branch of the trigeminal nerve
V2 = maxillary branch of the trigeminal nerve

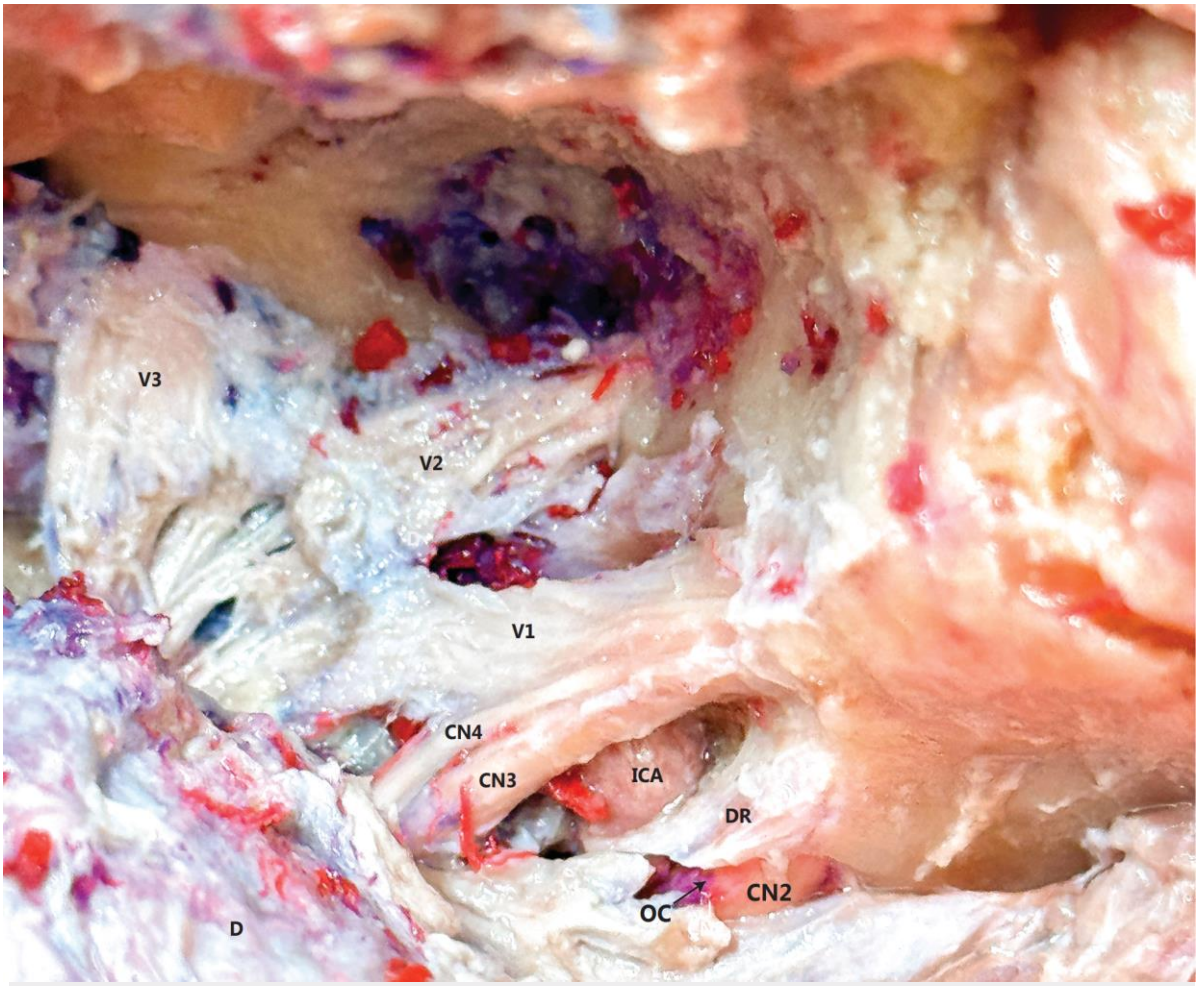
CN 4 = trochlear nerve
CN2 = optic nerve
OR = orbital roof
RS = ridge of sphenoid
MMA = middle meningeal artery
D = dura matter overlying lateral wall of cavernous sinus



Extradural anterior clinoidectomy.
VIII. Exoposure of the dura matter overlying the clinoidal segment of internal carotid artery (ICA).

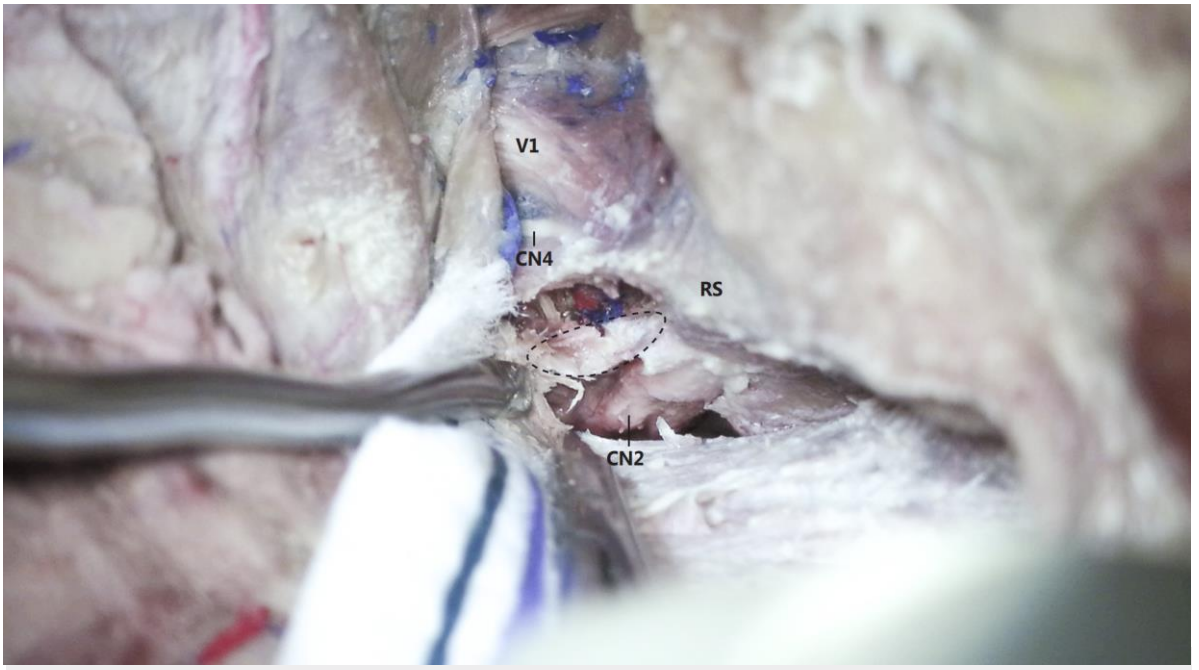
V1 = ophthalmic branch of the trigeminal nerve
V2 = maxillary branch of the trigeminal nerve

CN 4 = trochlear nerve
CN2 = optic nerve
OC = optic canal
RS = ridge of sphenoid
MMA = middle meningeal artery
D = dura matter overlying lateral wall of cavernous sinus
D = dural ring



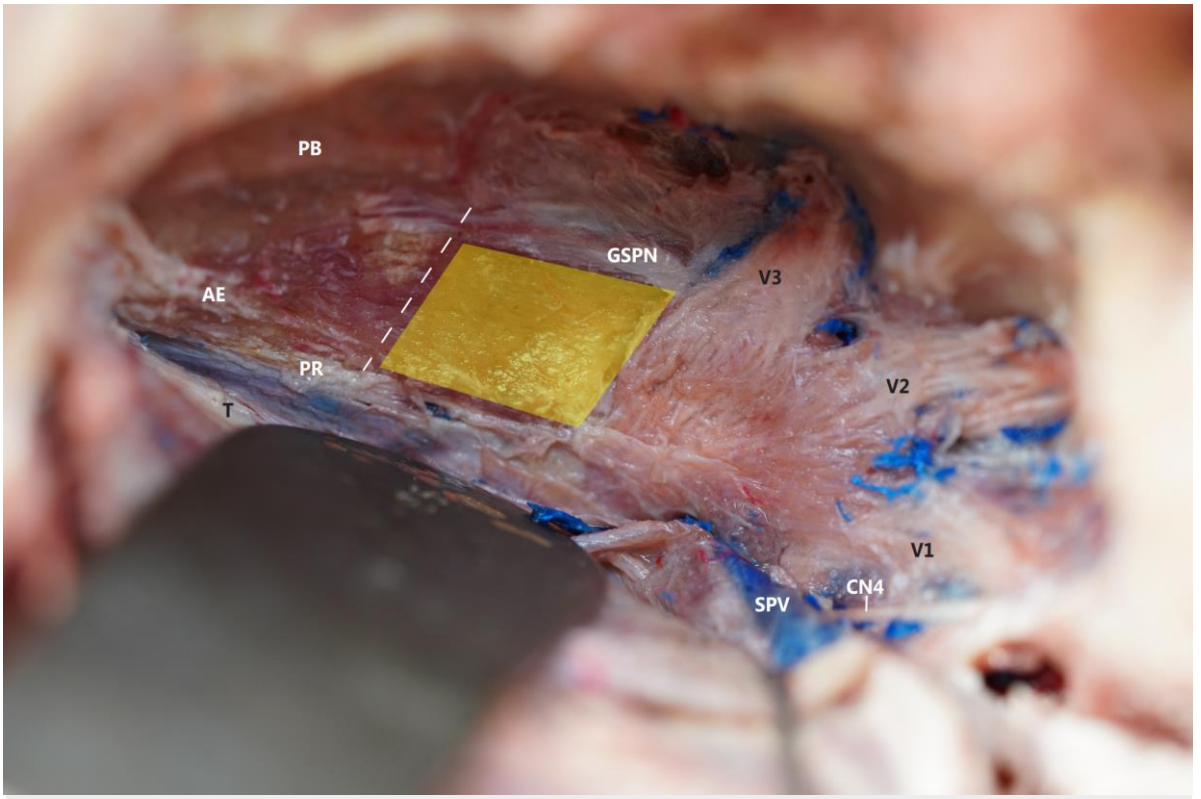
Extradural anterior clinoidectomy.
IX. Exposure of clinoidal segment of ICA

CN3 = oculomotor nerve
CN4 = trochlear nerve
D = dura mater
V1 = ophthalmoc branch of trigeminal nerve
V2 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
CN2 = optic nerve
MCF = middle cranial fossa
OC = optic canal
ICA = clinoidal segment of ICA
DR = distal dural ring



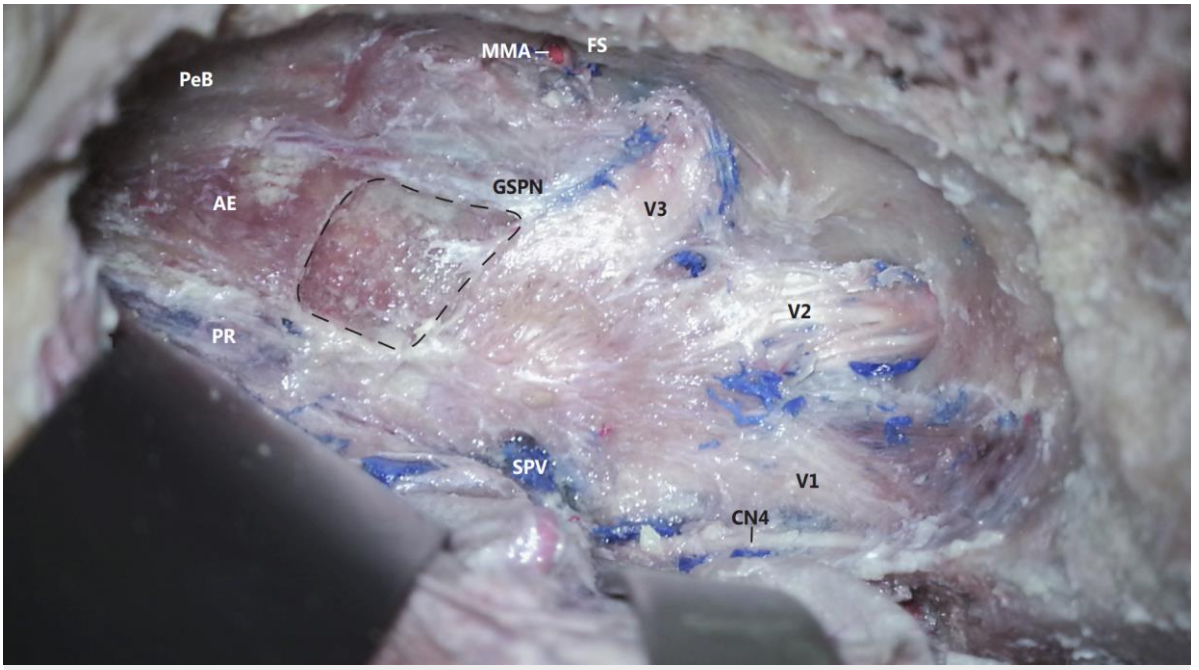
Extradural anterior clinoidectomy.

Black dashed line = dural ring
V1 = ophthalmic branch of the trigeminal nerve
CN4 = trochlear nerve
CN2 = optic nerve
OR = orbital roof
OC = optic canal
RS = ridge of sphenoid



Petrosectomy
I. Yellow highlighted area demonstrate the appropriate location of the petrosectomy.

AE = Arcuate eminence
PR = Petrous bone ridge
V2 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
PB = petrosal bone
T = tentorium cerebelli
V1 = ophthalmic branch of the trigeminal nerve
SPV = superior petrosal vein
GSPN = greater supercial petrosal nerve
White dashed line = lateral extent of the petrosectomy

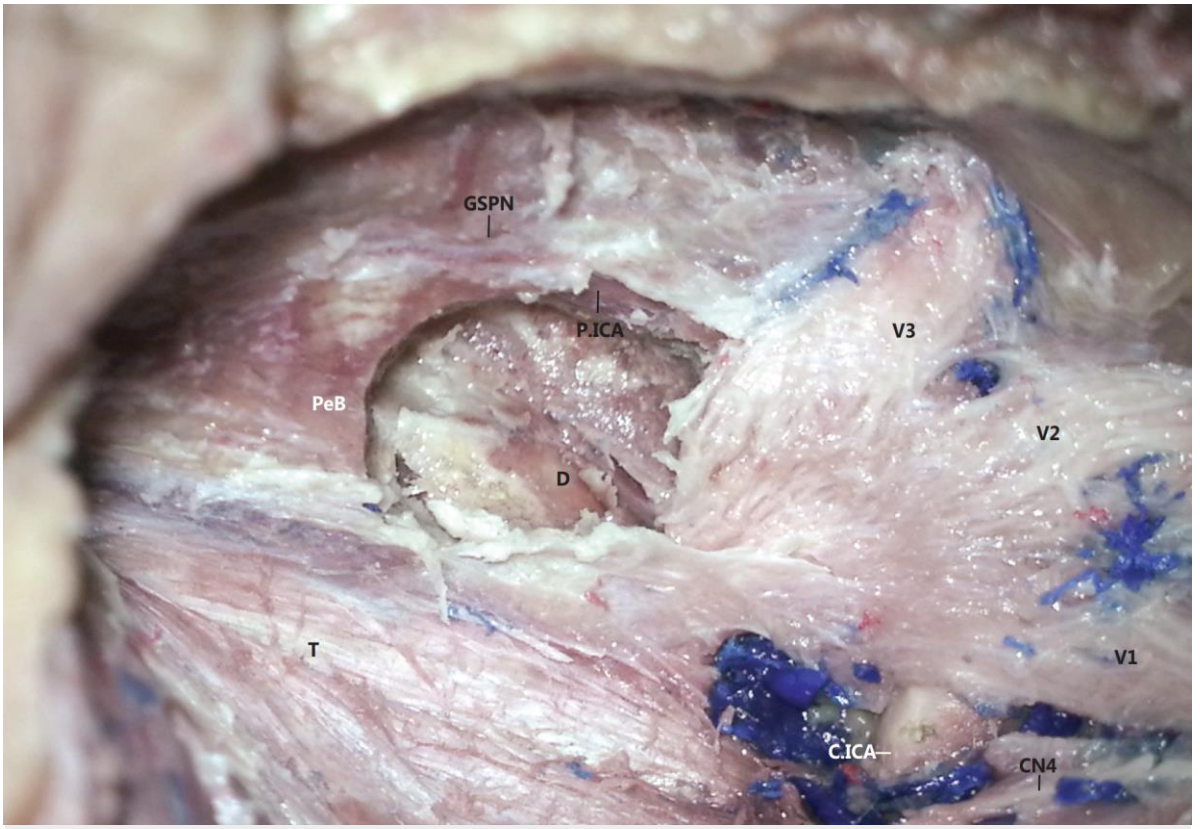


Petrosectomy
II. Area of drilling marked with black dashed line

AE: Arcuate eminence
PR: Petrous bone ridge
FS: Foramen spinosum

V1 = ophthalmic branch of the trigeminal nerve
V3 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
CN 4 = trochlear nerve
SPV = superior pterosal vein

PeB = petrosal bone
MMA = middle meningeal artery
GSPN = greater supercial petrosal nerve

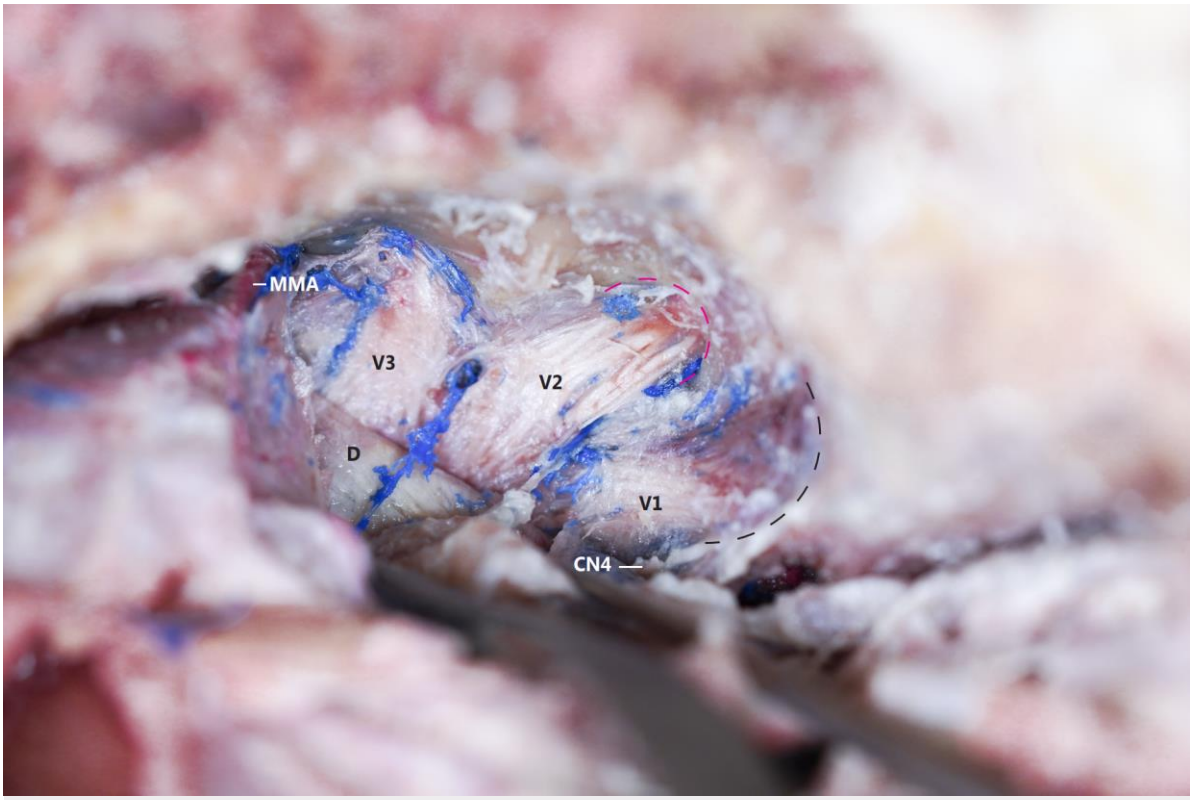


Petrosectomy
III. Exposure of the dura overlying the posterior fossa.

T = tentorium cerebelli
PB = petrosal bone

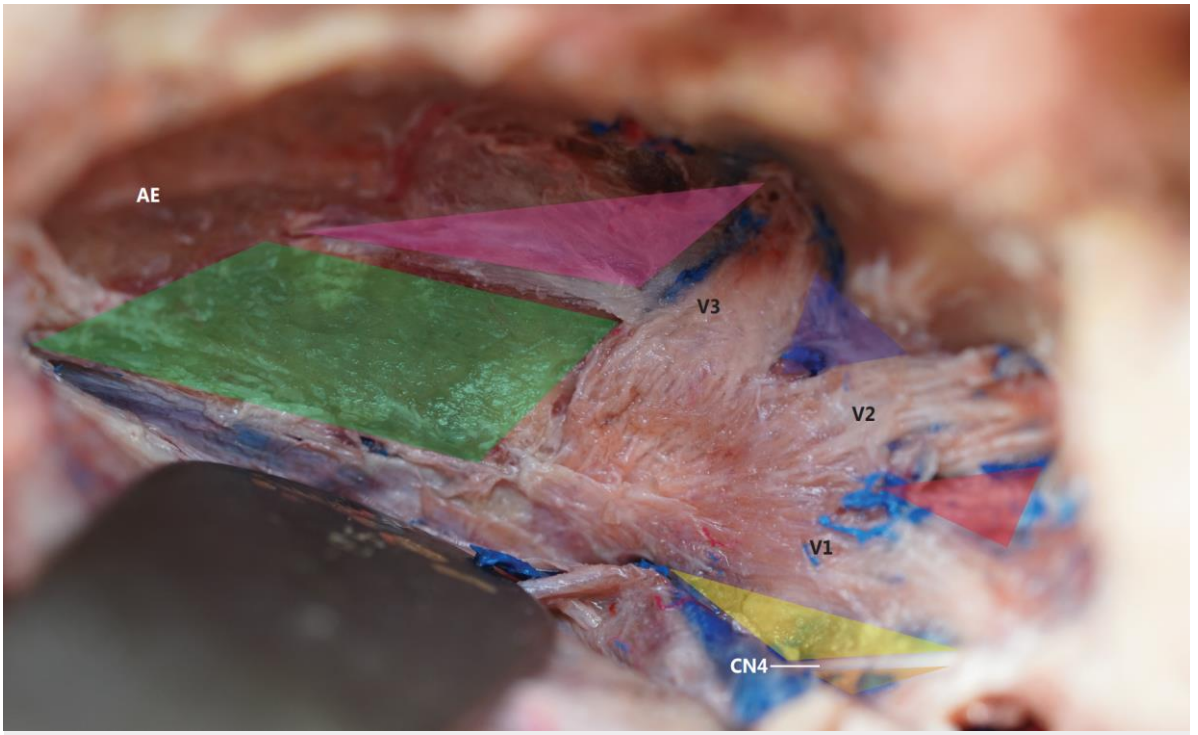
V1 = ophthalmic branch of the trigeminal nerve
V3 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
CN 4 = trochlear nerve
D = dura overlying posterior fossa

GSPN = greater supercial petrosal nerve
C.ICA = cavernous segment of ICA
P.ICA = petrous segment of ICA



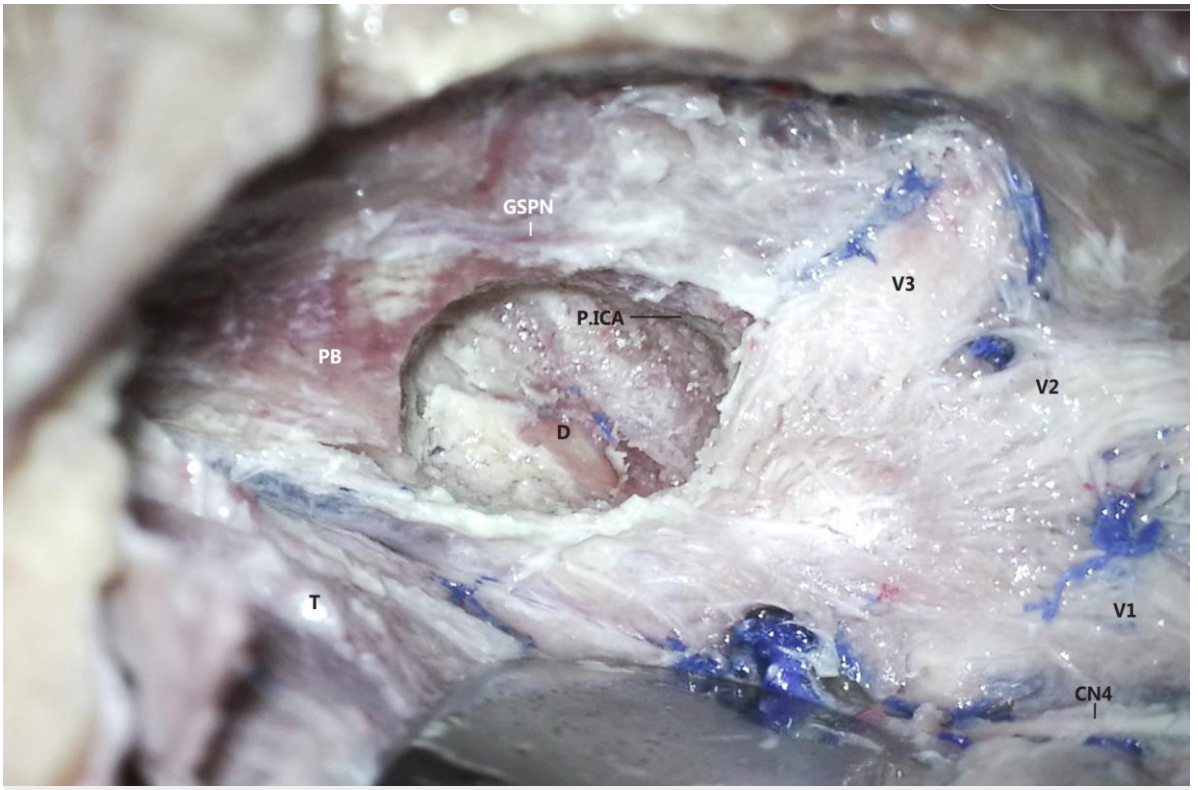
Black dashed line = superior orbital ssure
Pink dashed line = foramen rotundum

V1 = ophthalmic branch of the trigeminal nerve
V3 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
CN4 = trochlear nerve
RS = ridge of sphenoid
D = dura matter overlying lateral wall of cavernous sinus



Supratrochlear triangle = orange shaded area
Anteriolateral triangle = blue shaded area
AE = Arcuate eminence
CN 4 = trochlear nerve

V1 = ophthalmic branch of the trigeminal nerve
V3 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
Kawase posteromedial triangle = green shaded area
Glasscock posterolteral triangle = pink shaded area
Infratrochlear triangle = yellow shaded area



Extradural anterior clinoidectomy.
VIII. Exposure of the dura matter overlying the clinoidal segment of internal carotid artery (ICA).

D = dura overlying posterior fossa

T = tentorium cerebelli

PB = petrous bone

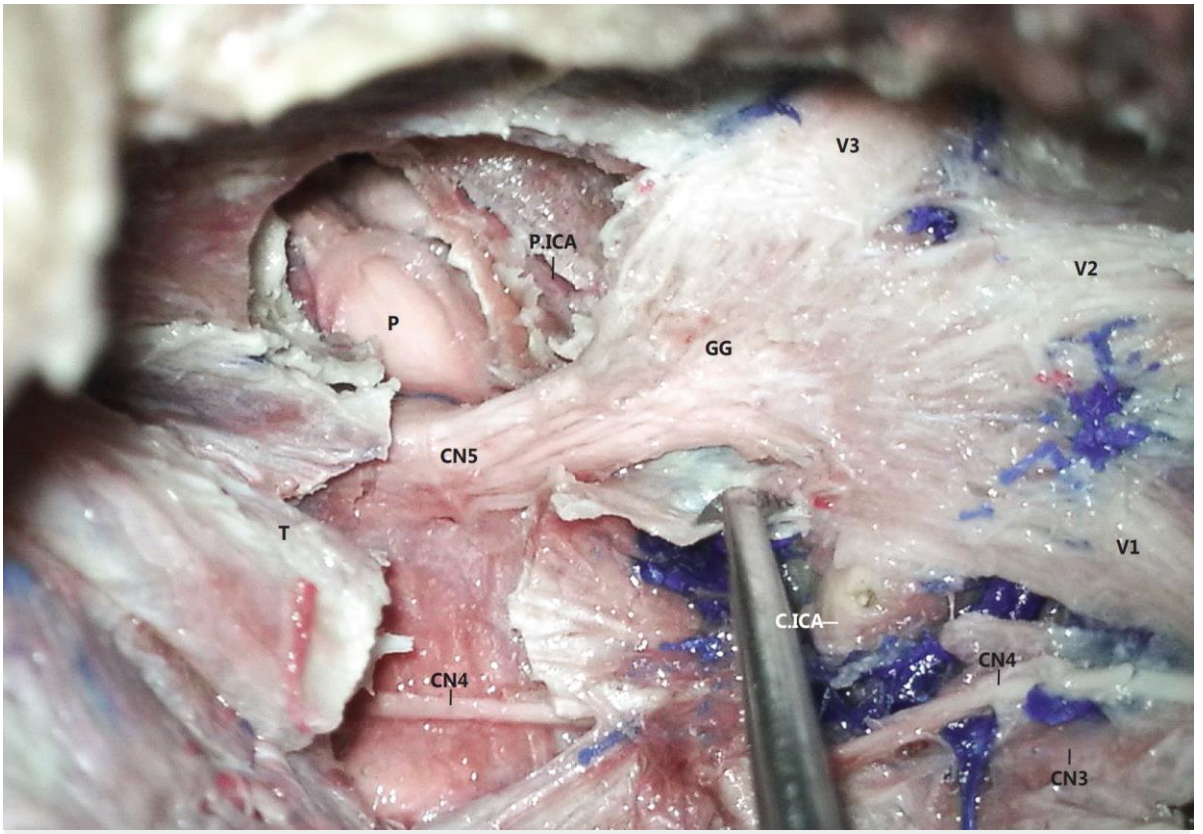
V1 = ophthalmic branch of the trigeminal nerve

V3 = maxillary branch of the trigeminal nerve

V3 = mandibular branch of the trigeminal nerve

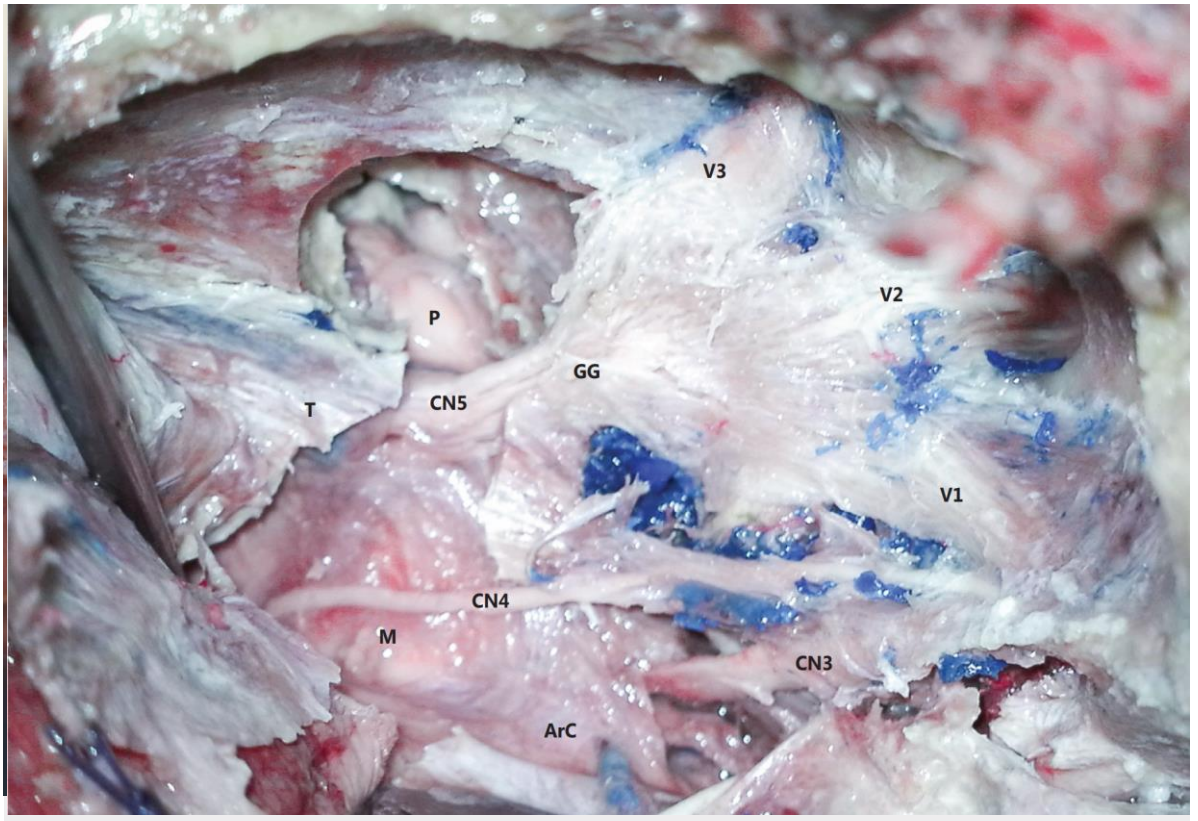
CN 4 = trochlear nerve

P. ICA = petrous segment of internal carotid artery



Petrosectomy was performed and supra and infratentorial dura were incised.

T = tentorium cerebelli
P = pons
CN5 = trigeminal nerve
V1 = ophthalmic branch of the trigeminal nerve
V3 = maxillary branch of the trigeminal nerve
V3 = mandibular branch of the trigeminal nerve
CN 4 = trochlear nerve
CN3 = oculomotor nerve
GG = gasserian ganglion
C.ICA = cavernous segment of ICA
P.ICA = petrous segment of ICA



Extradural anterior clinoidectomy.
VIII. Exoposure of the dura matter overlying the clinoidal segment of internal carotid artery (ICA).

P = pons

M = midbrain

CN5 = trigeminal nerve

V1 = ophthalmic branch of the trigeminal nerve

V3 = maxillary branch of the trigeminal nerve

V3 = mandibular branch of the trigeminal nerve

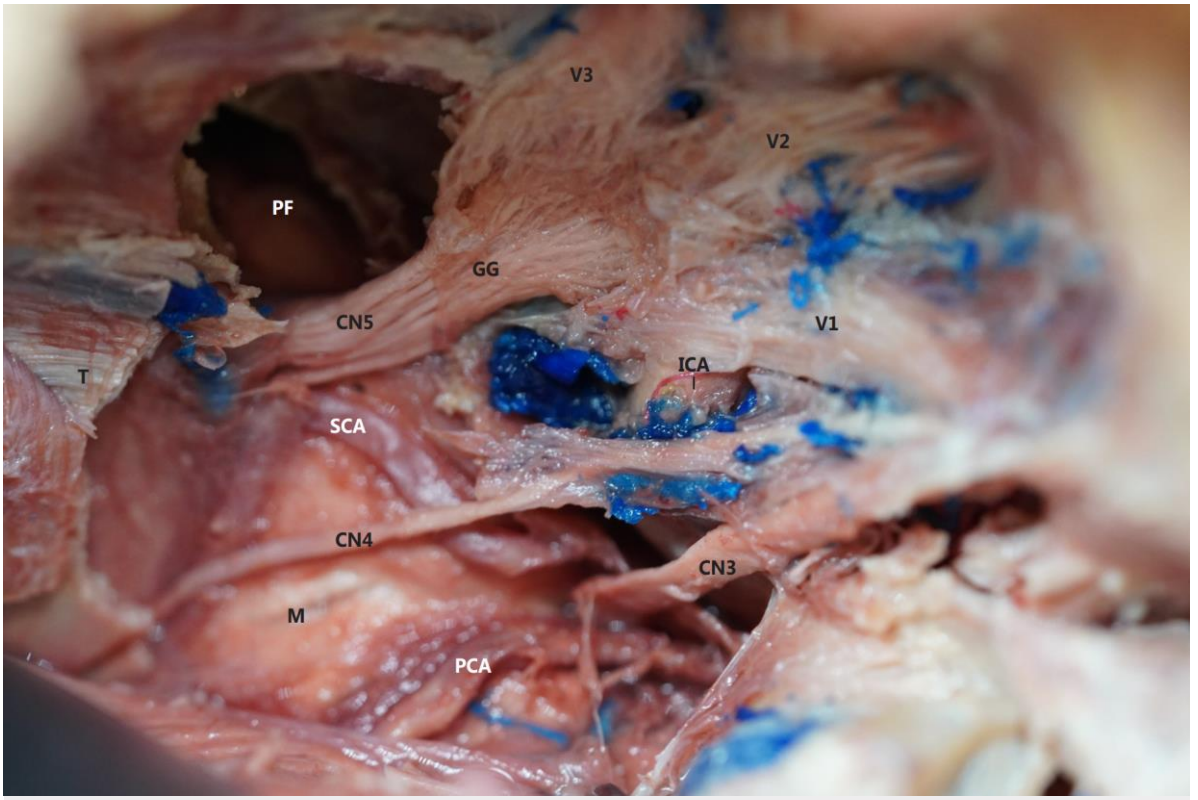
CN 4 = trochlear nerve

T = tentorium cerebelli

CN3 = oculomotor nerve

GG = gasserian ganglion

ArC = arachnoid layer overlying the midbrain



Extradural Subtemporal Transzygormatic Approach

PCA = posterior cerebral artery

M = midbrain

CN5 = trigeminal nerve

V1 = ophthalmic branch of the trigeminal nerve

V2 = maxillary branch of the trigeminal nerve

V3 = mandibular branch of the trigeminal nerve

CN 4 = trochlear nerve

T = tentorium cerebelli

SCA = superior cerebellar artery

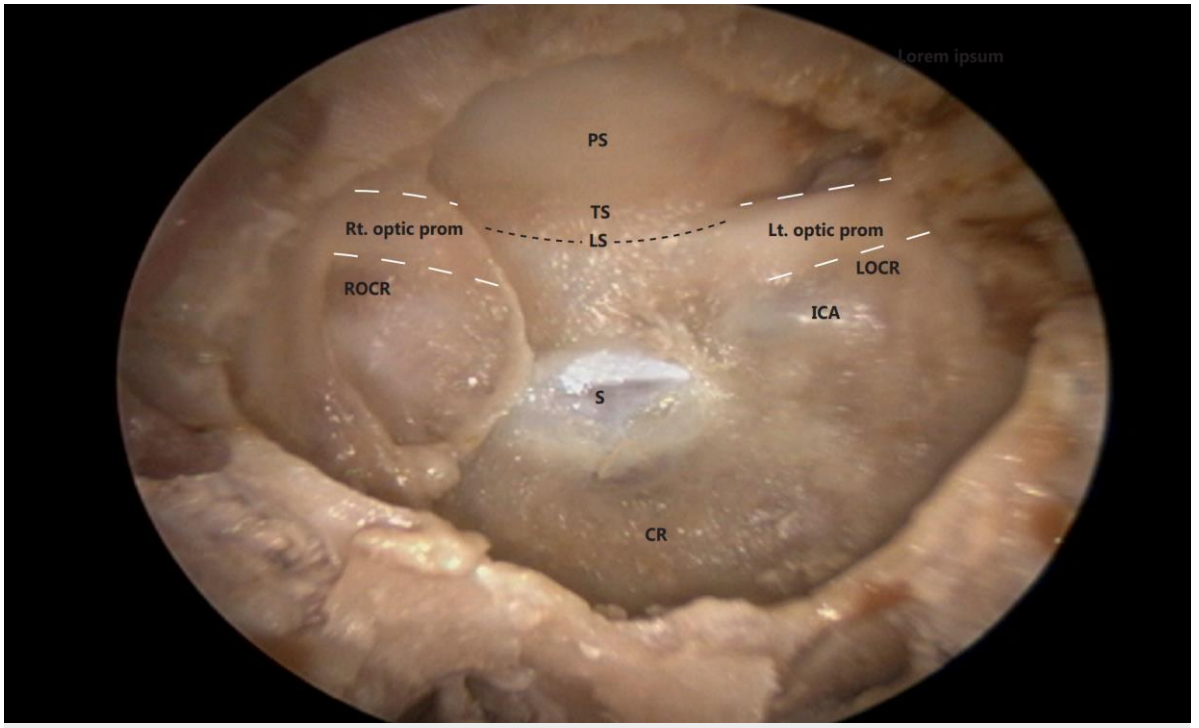
CN4 = troclear nerve

CN3 = oculomotor nerve

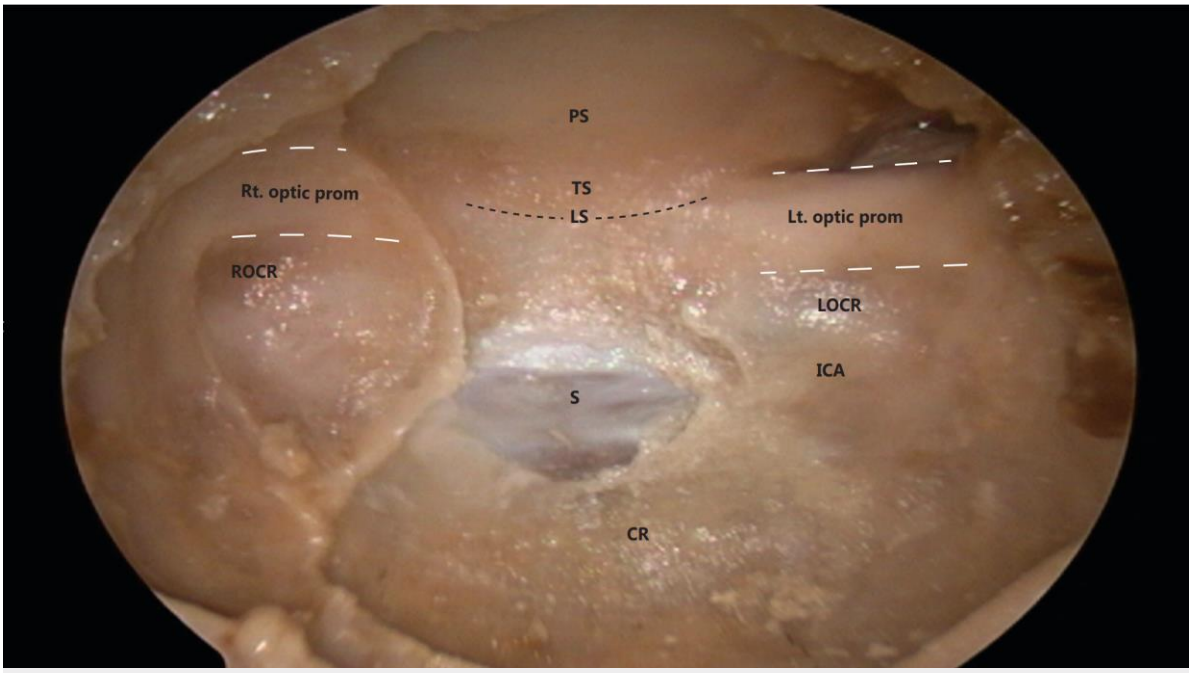
GG = gasserian ganglion

ICA = cavernous segment of internal carotid artery

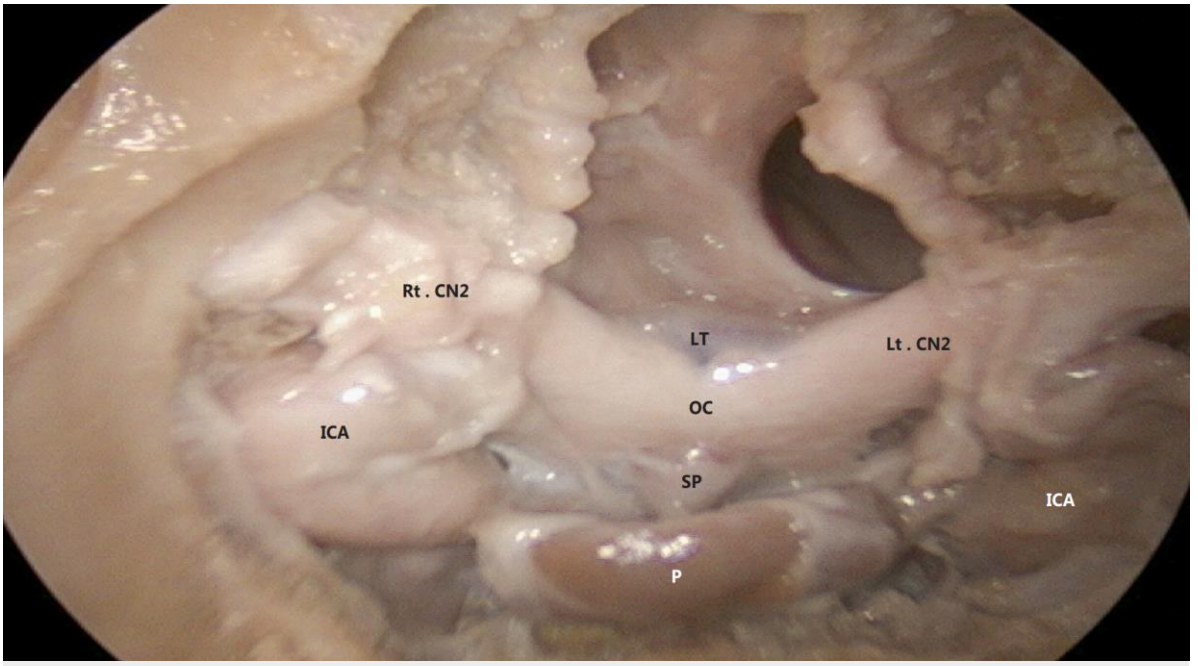
PF = posterior fossa



PS = planum sellae
LS = limbus sphenoidale
TS = tuberculum sellae
ROCR = right lateral optic-carotid recess
LOCR = leftlateral optic-carotid recess
S = sella
CR = clival recess
ICA = cavernous segment of internal carotid artery
Rt. opric prom = right prominence of optic nerve
Lt. opric prom = left prominence of optic nerve

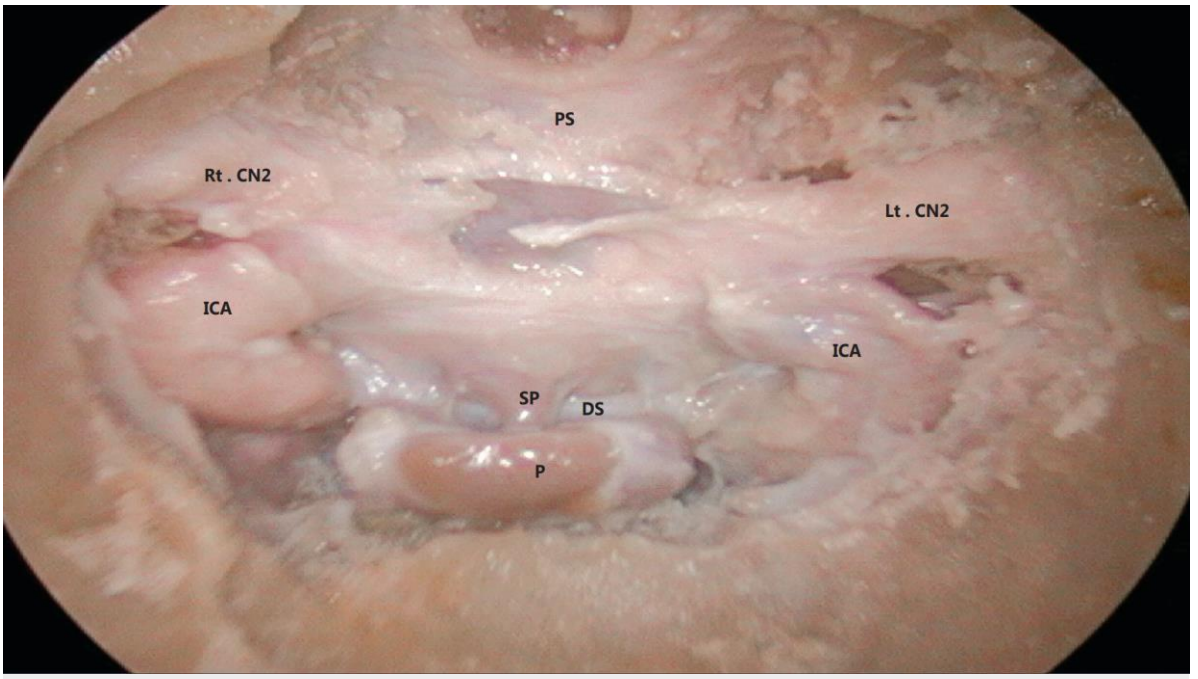


PS = planum sellae
LS = limbus sphenoidale
TS = tuberculum sellae
ROCR = right lateral optic-carotid recess
CR = clival recess
ICA = cavernous segment of internal carotid artery
Rt. optic prom = right prominence of optic nerve
LOCR = left lateral optic-carotid recess
S = sella
Lt. optic prom = left prominence of optic nerve



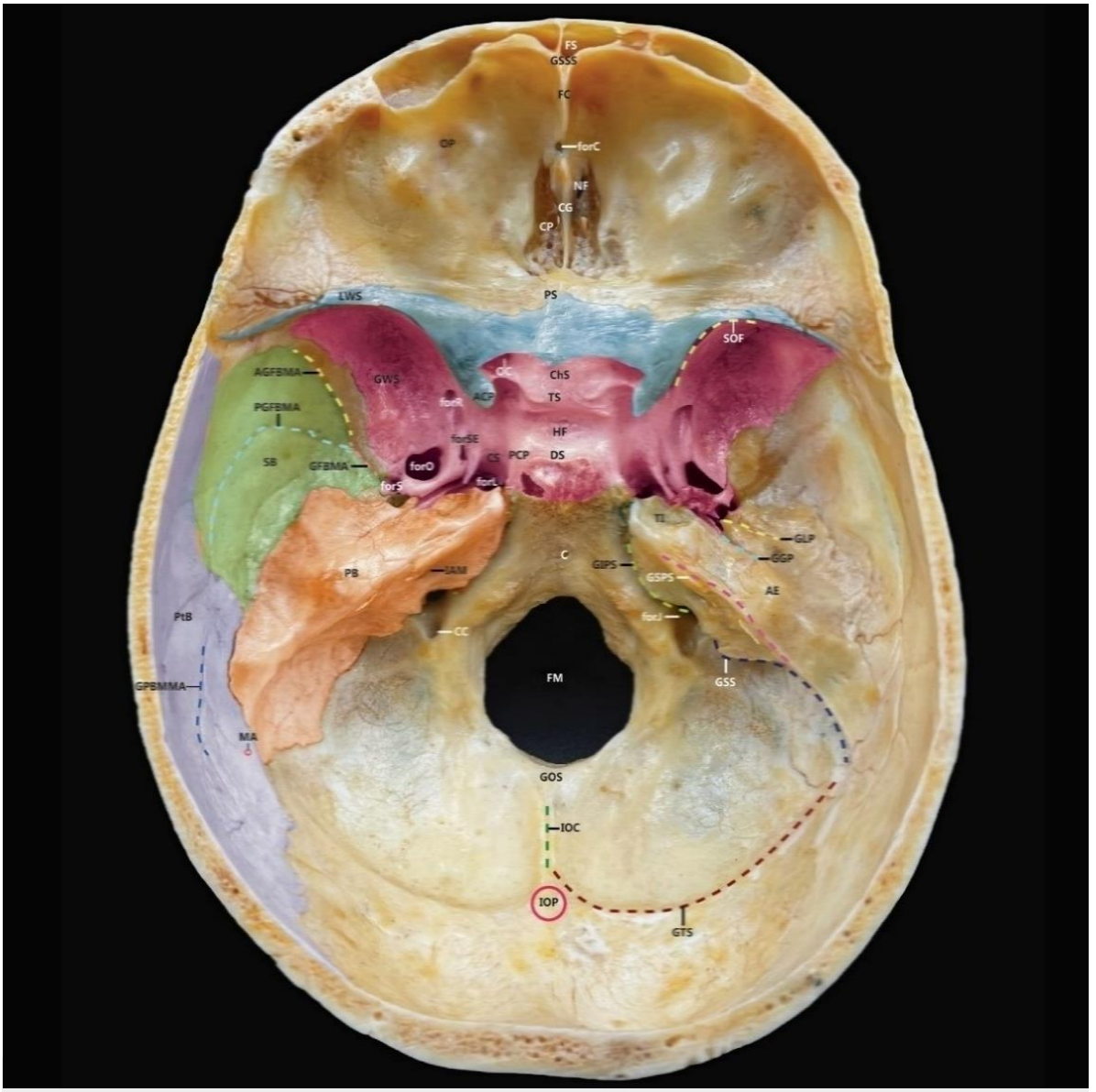
ICA = cavernous segment of internal carotid artery
Rt. CN2 = right optic nerve
Lt. CN2 = left optic nerve

SP = stalk of pituitary
P = pituitary
LT = lamina terminalis
OC = chiasm



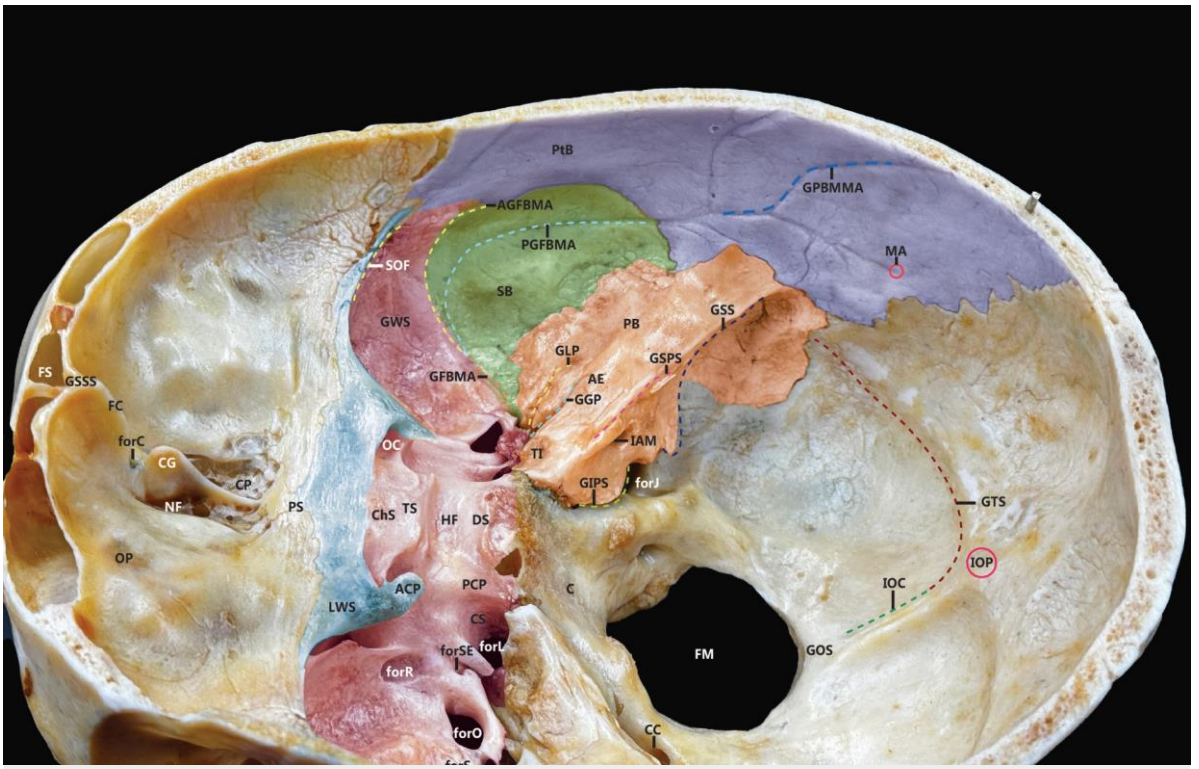
PS = planum sellae
DS = diaphragm sellae
ICA = cavernous segment of internal carotid artery

Rt. CN2 = right optic nerve
Lt. CN2 = left optic nerve
SP = stalk of pituitary
P = pituitary



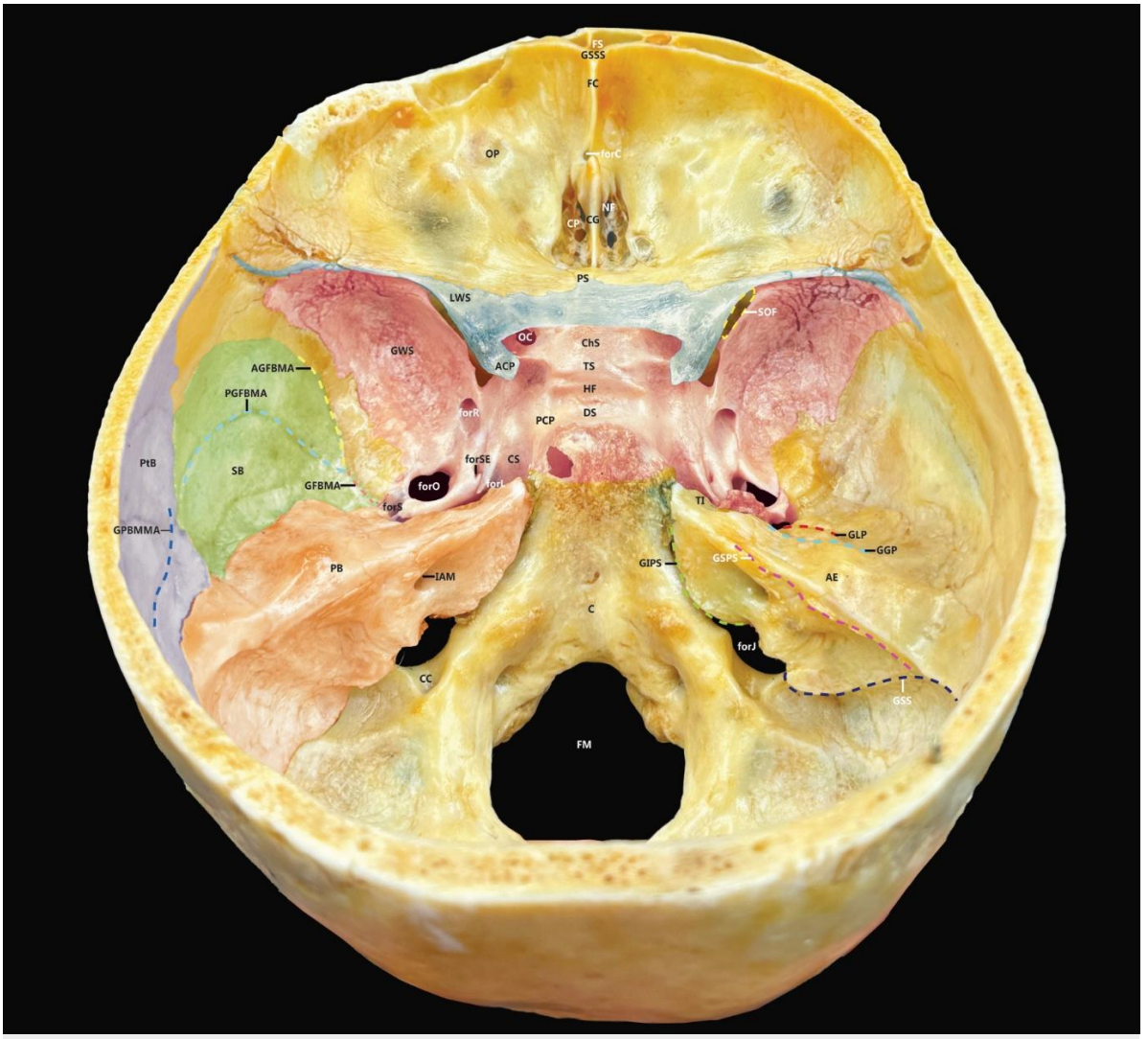
Superior view of opened skull.

FS = frontal sinus
GSSS = groove of superior sagittal sinus
FC = frontal crest
forC = foramen cecum
OP = orbital part of frontal bone
NF = nasal fissure
CG = crista galli
CP = cribriform plate
PS = planum sphenoidale
Chs = chiasmatic sulcus
TS = tuberculum sellae
HF = hypophysial fossa
DS = dorsum sellae
PCP = posterior clinoid process
CS = carotid sulcus
forL = foramen lacerum
LWS = lesser wing of sphenoidal bone
ACP = anterior clinoid process
OP = optic canal
SOF = superior orbital fissure
GWS = greater wing of sphenoidal bone
forR = foramen rotundum
forSE = foramen of sphenoidal emissary
for = foramen ovale
fors = foramen spinosum
GFBMA = groove of frontal branch of middle meningeal artery
AGFBMA = anterior GFBMA
PGFBMA = posterior GFBMA
SB = squamous bone
PB = petrosal bone
IAM = internal acoustic meatus
PtB = parietal bone
GPBMMA = groove of posterior branch of middle meningeal artery
MA = mastoid angle
CC = condylar canal
forJ = jugular foramen
GLP = groove of lesser petrosal
GGP = groove of greater petrosal
TI = trigeminal impression
AE = arcuate eminence
GSPS = groove of superior petrosal sinus
GIPS = groove of inferior petrosal sinus
GSS = groove of sagittal sinus
GTS = groove of transverse sinus
IOP = internal occipital protuberance
IOC = internal occipital crest
GOS = groove of occipital sinus
C = clivus
FM = foramen magnum



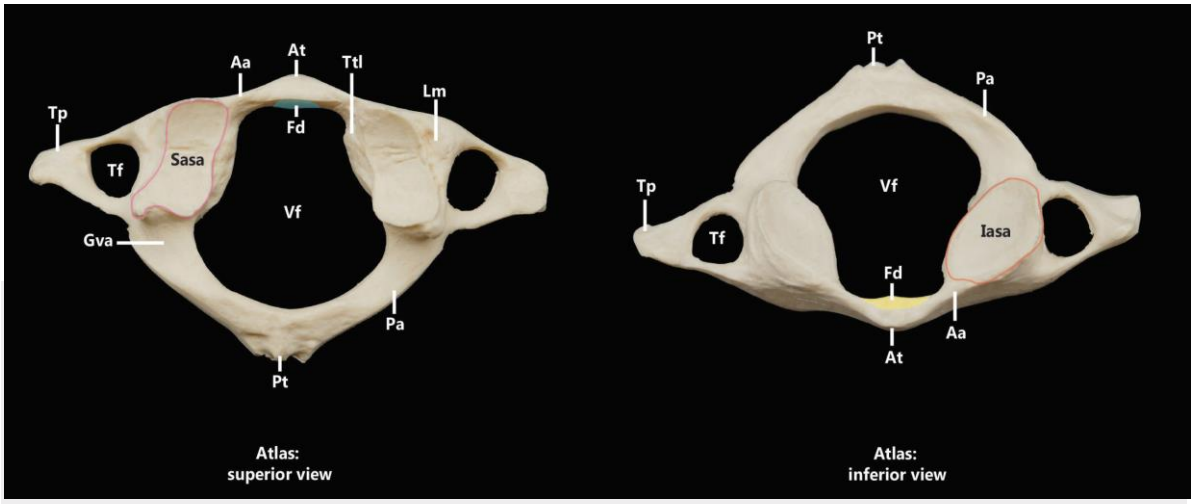
Lateral view of opened skull.

FS = frontal sinus
GSSS = groove of superior sagittal sinus
FC = frontal crest
forC = foramen cecum
OP = orbital part of frontal bone
NF = nasal fissure
CG = crista galli
CP = cribriform plate
PS = planum sphenoidale
Chs = chiasmatic sulcus
TS = tuberculum sellae
HF = hypophysial fossa
DS = dorsum sellae
PCP = posterior clinoid process
CS = carotid sulcus
for = foramen lacerum
LWS = lesser wing of sphenoidal bone
ACP = anterior clinoid process
OP = optic canal
SOF = superior orbital fissure
GWS = greater wing of sphenoidal bone
forR = foramen rotundum
forSE = foramen of sphenoidal emissary
for = foramen ovale
fors = foramen spinosum
FBMA = groove of frontal branch of middle meningeal artery
AGFBMA = anterior GFBMA
PGFBMA = posterior GFBMA
SB = squamous bone
PB = petrosal bone
IAM = internal acoustic meatus
PtB = parietal bone
GPBMMA = groove of posterior branch of middle meningeal artery
MA = mastoid angle
CC = condylar canal
forJ = jugular foramen
GLP = groove of lesser petrosal
GGP = groove of greater petrosal
TI = trigeminal impression
AE = arcuate eminence
GSPS = groove of superior petrosal sinus
GIPS = groove of inferior petrosal sinus
GSS = groove of sagittal sinus
GTS = groove of transverse sinus
IOP = internal occipital protuberance
IOC = internal occipital crest
GOS = groove of occipital sinus
C = clivus
FM = foramen magnum



Superior view of opened skull.

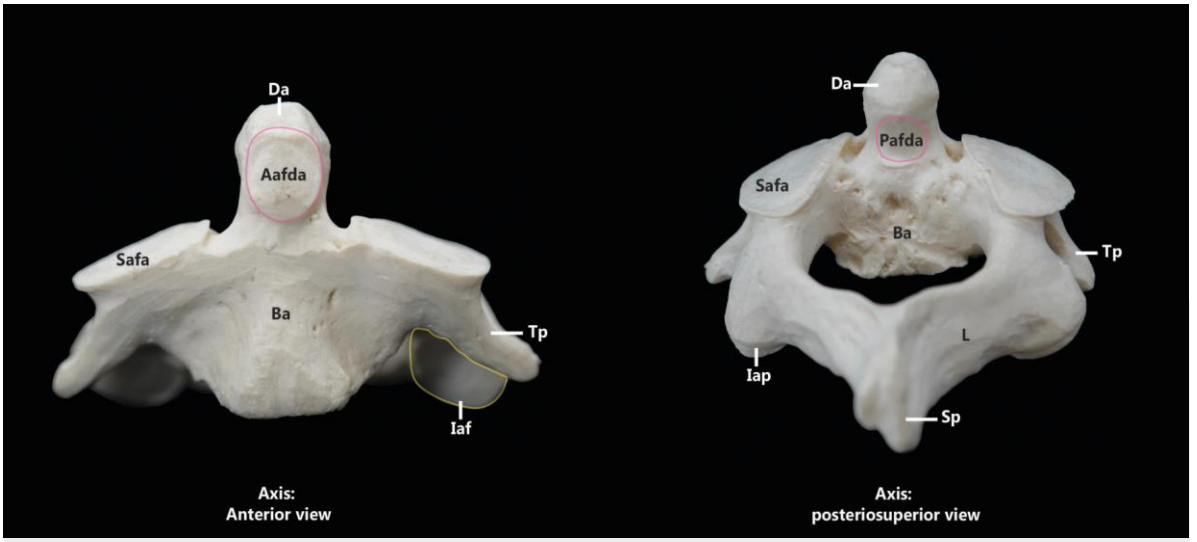
FS = frontal sinus
GSSS = groove of superior sagittal sinus
FC = frontal crest
forC = foramen cecum
OP = orbital part of frontal bone
NF = nasal fissure
CG = crista galli
CP = cribriform plate
PS = planum sphenoidale
Chs = chiasmatic sulcus
TS = tuberculum sellae
HF = hypophysial fossa
DS = dorsum sellae
PCP = posterior clinoid process
CS = carotid sulcus
forL = foramen lacerum
LWS = lesser wing of sphenoidal bone
ACP = anterior clinoid process
OP = optic canal
SOF = superior orbital fissure
GWS = greater wing of sphenoidal bone
forR = foramen rotundum
forSE = foramen of sphenoidal emissary
for = foramen ovale
fors = foramen spinosum
GFBMA = groove of frontal branch of middle meningeal artery
AGFBMA = anterior GFBMA
PGFBMA = posterior GFBMA
SB = squamous bone
PB = petrosal bone
IAM = internal acoustic meatus
PtB = parietal bone
GPBMMA = groove of posterior branch of middle meningeal artery
CC = condylar canal
forJ = jugular foramen
GLP = groove of lesser petrosal
GGP = groove of greater petrosal
TI = trigeminal impression
AE = arcuate eminence
GSPS = groove of superior petrosal sinus
GIPS = groove of inferior petrosal sinus
GSS = groove of sagittal sinus
C = clivus
FM = foramen magnum



Tp = transverse process
Tf = transverse foramen
Aa = anterior arch
Pt = posterior tubercle
Pa = posterior arch

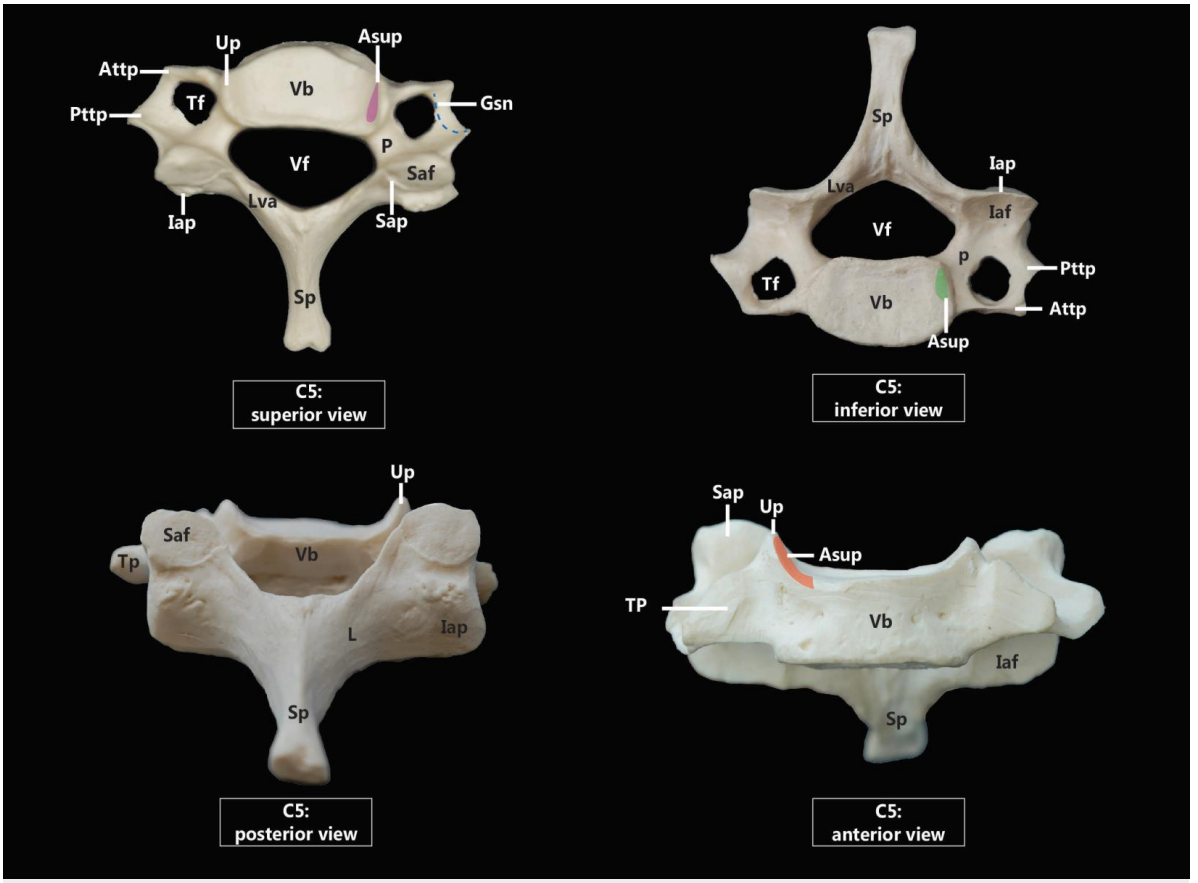
Sasa = superior articular surface of atlas
Aa = anterior arch
Pt = posterior tubercle
Pa = posterior arch
Fd = facet for dens
Vf = vertebral foramen
Iasa = inferior articular surface of atlas

At = anterior tubercle
Ttl = tubercle of transverse ligament
Lm = lateral mass
Gva = groove for vertebral artery



Safa = superior articular facet of axis
Da = dens axis
Aafda = anterior articular facet of dens axis
Ba = body of axis

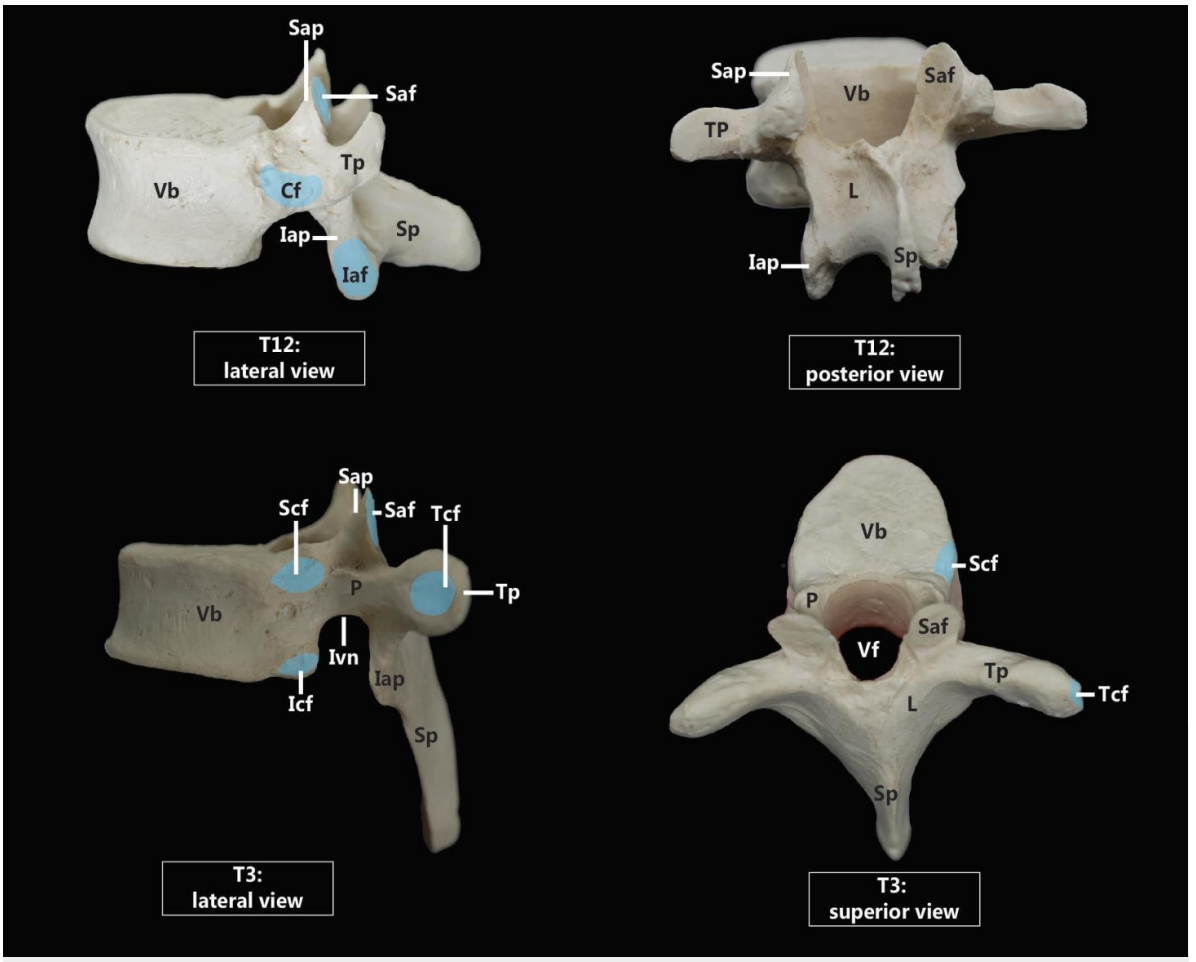
Tp = transverse process
Iaf = inferior articular facet
Pafda = posterior articular facet of dens axis
Iap = inferior articular process
Sp = spinous process



Attp = anterior tubercle of transverse process
Pttp = posterior tubercle of transverse process
Up = uncinate process

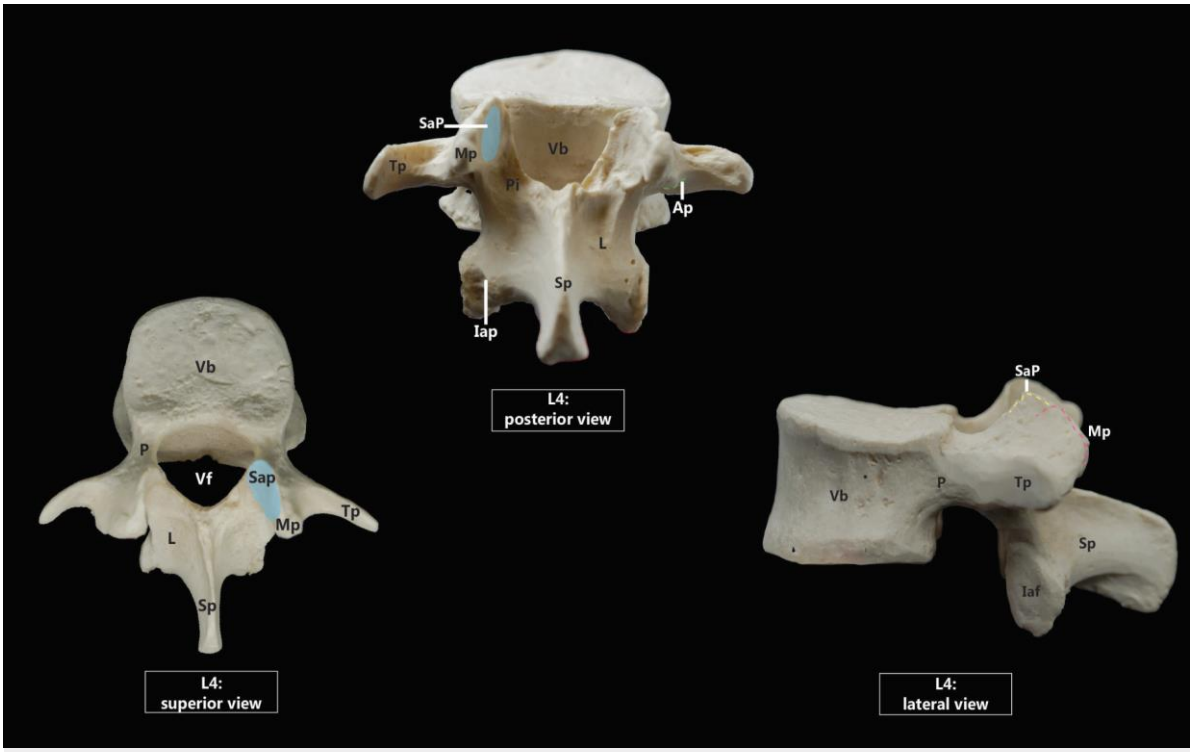
Saf = superior articular facet
Sap = superior articular process
Lva = lamina of vertebral arch
Iap = inferior articular process
VF = vertebral foramen
Sp = spinous process
Tp = transverse process
Iaf = inferior articular facet

Tf = transverse foramen
Vb = vertebral body
Asup = articular surface of uncinate process
Gsn = groove for spinal nerves
P = pedicle



Vb = vertebral foramen
Sap = superior articular process
Saf = superior articular facet
Cf = costal facet
Tp = transverse process
Iap = inferior articular process
Iaf = inferior articular facet
Sp = spinous process

L = lamina
Scf = superior costal facet
Icf = inferior costal facet
Tcf = transverse costal facet
Ivn = inferior vertebral notch
P = pedicle
Vf = vertebral foramen



Vb = vertebral body
P = pedicle
L = lamina
Sp = spinous process
Sap = superior articular process

Iap = inferior articular process
Ap = accessory process
Iaf = inferior articular facet
Vf = vertebral foramen
Mp = mammillary process
Tp = transverse process
Pi = pars interarticularis

The Neuraon Atlas Team

Head of Neuroan Atlas

Mohammed Bafaqeeh

MD, FRCSc , KFMC, Riyadh, KSA

Supervisors

Abdullah Alobaid
Consultant Neurosurgeon

Fawaz Alotaibi - Program Director
Consultant Neurosurgeon

Mohammed Alshardan
Consultant Neurosurgeon

Founders of Neuroanatomy Research Group

Mohammed Bafageeh
Neurosurgery Consultant

Faris Yagmoor
Neurosurgery Consultant

Abdulaziz Almousa
Neurosurgery Consultant

Founders of Neuroan Atlas

Mohammed Bafaqeeh
Neurosurgery Consultant

Nada Alnefaie
Neurosurgery Resident

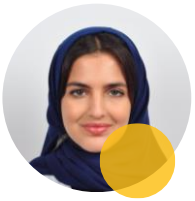
Tariq Rania
Assistant Neurosurgeon

Noor Alghanim
Neurosurgery Resident

Team of Neuroan Atlas

Scientific Content Developers

Mohammed Alatyah
Medical Intern
Group Leader & Photography



Rahaf Alanazi
Medical Intern
Website Developer

Fahad Mobaireek
Medical student
Photography

Hassan Mohammed Alturaiki
Medical Intern
Editor

Ola Mohammed Bin Shilash
Medical Student
Co-editor

Zahra Hassan AlGhazwi
Medical Student
Co-editor

Abdulaziz Almotairi
Medical Intern

Nourah Alotabi
Medical intern

Mohammed Almanna
Medical intern

Mohannad Mallat
Medical student

Hassan Alradhai
Medical student

Team members of Neuroan Atlas

Salman Alqazlan
Neurosurgery Resident

Meshal Alharbi
Neurosurgery Resident

Hattan Bosi
Neurosurgery Resident

Sara Aljaber
Neurosurgery Resident

Ahoud Alharbi
Neurosurgery Resident

أطلس التشريح العصبي

Neuroan Atlas