Treatment of Skull Base CSF Leaks

Ray Chu MD

Associate Professor

Brain Tumor Center

Cedars Sinai

Department of Neurosurgery

- No relevant disclosures
- NFL Neurotrauma Consultant

WANTED

BY POLICE

6'6"
6'4"
6'2"
6'0"
5'10"
5'8"
5'6"
5'4"
5'2"
5'0"

POLICE DEPARTMENT

BAD BOY

45348754

J Neurosurg 116:749–754, 2012

Lack of causal association between spontaneous intracranial hypotension and cranial cerebrospinal fluid leaks

Clinical article

Wouter I. Schievink, M.D.,[1] Marc S. Schwartz, M.D.,[1,2] M. Marcel Maya, M.D.,[3] Franklin G. Moser, M.D., M.M.M.,[3] and Todd D. Rozen, M.D.[4]

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Object. Spontaneous intracranial hypotension is an important cause of headaches and an underlying spinal CSF leak can be demonstrated in most patients. Whether CSF leaks at the level of the skull base can cause spontaneous intracranial hypotension remains a matter of controversy. The authors' aim was to examine the frequency of skull base CSF leaks as the cause of spontaneous intracranial hypotension.

Methods. Demographic, clinical, and radiological data were collected from a consecutive group of patients evaluated for spontaneous intracranial hypotension during a 9-year period.

Results. Among 273 patients who met the diagnostic criteria for spontaneous intracranial hypotension and 42 who did not, not a single instance of CSF leak at the skull base was encountered. Clear nasal drainage was reported by 41 patients, but a diagnosis of CSF rhinorrhea could not be established. Four patients underwent exploratory surgery for presumed CSF rhinorrhea. In addition, the authors treated 3 patients who had a postoperative CSF leak at the skull base following the resection of a cerebellopontine angle tumor and developed orthostatic headaches; spinal imaging, however, demonstrated the presence of a spinal source of CSF leakage in all 3 patients.

Conclusions. There is no evidence for an association between spontaneous intracranial hypotension and CSF leaks at the level of the skull base. Moreover, the authors' study suggests that a spinal source for CSF leakage should even be suspected in patients with orthostatic headaches who have a documented skull base CSF leak.

(http://thejns.org/doi/abs/10.3171/2011.12.JNS111474)

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Spontaneous Intracranial Hypotension Due to Skull-Base Cerebrospinal Fluid Leak

Wouter I. Schievink MD, L. Madison Michael II MD, Marcel Maya MD, Paul Klimo Jr MD, Lucas Elijovich MD

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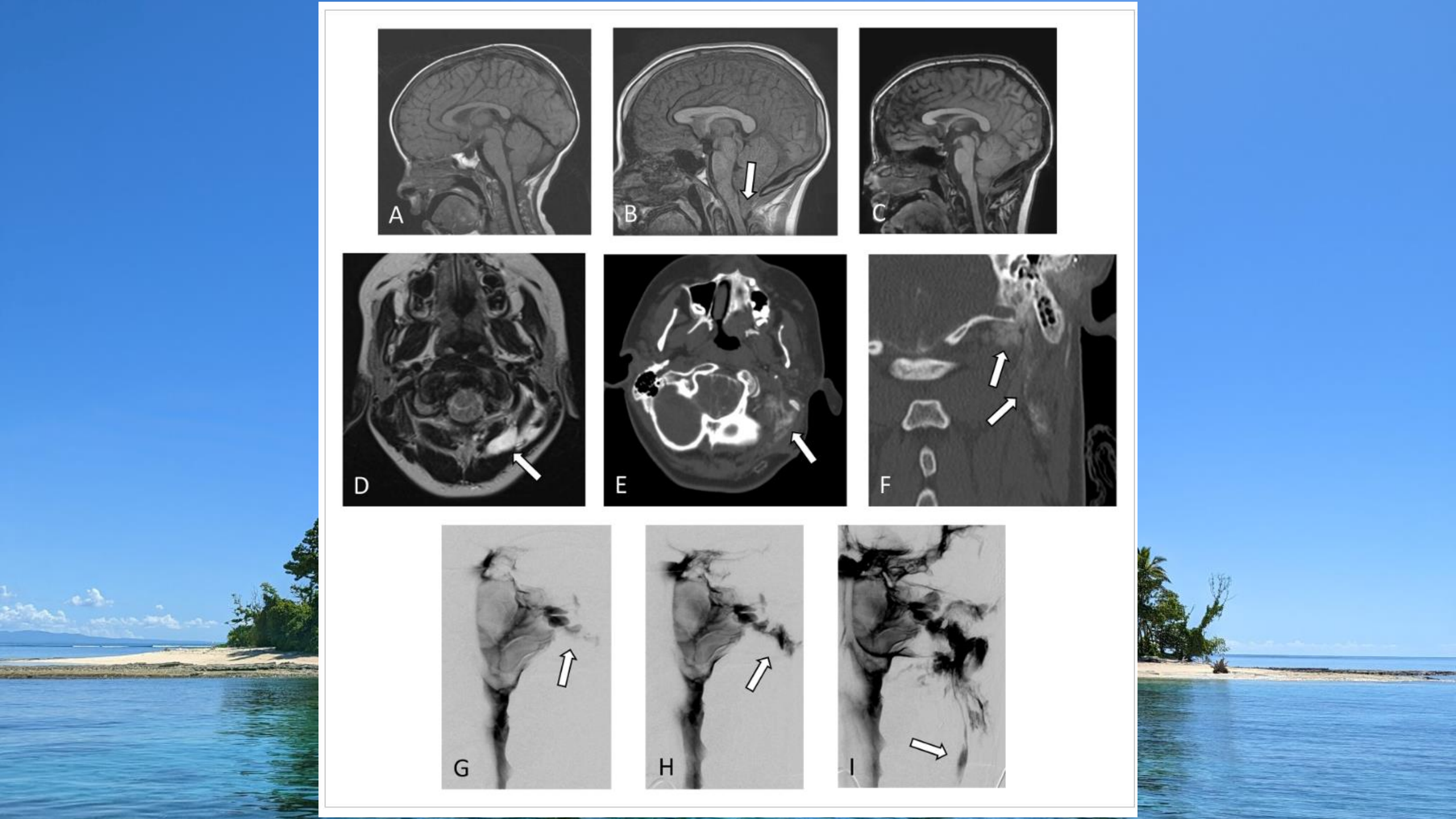
Orthostatic headaches developed in a 2-year-old boy. Magnetic resonance imaging (MRI) was normal (Fig, A) except for a subcranial cerebrospinal fluid (CSF) collection. At age 9 years, headaches worsened and MRI showed pachymeningeal enhancement and brain sagging (Fig, B). MRI and cisternography revealed a skull-base CSF leak with contrast filling the petrous apex air cells and tracking extracranially into the soft tissues of the neck (Fig, D–F) and eventually into the subclavian vein. The left skull base showed marked thinning of bony structures. The patient underwent a temporal craniotomy. The lateral squamous temporal bone was found to contain multiple bony defects leaking CSF, but no dural defects were identified. The bony defects were packed with autologous fat grafts. Headaches were unchanged, and he underwent a subcranial percutaneous n-butyl cyanoacrylate injection. Improvement of brain sagging was noted on follow-up MRI scan (Fig, C). High-pressure–type headaches and papilledema developed. CSF opening pressure was elevated (65cm H_2O, normal = 6–25cm H_2O). A ventriculoperitoneal shunt was placed and the high-pressure headaches and papilledema resolved. However, severe orthostatic headaches reoccurred 1 year later, and MRI showed worsening of the brain sagging. Digital subtraction myelogram then showed rapid flow of CSF entering the posterior cranial fossa from the cervical spinal canal and escaping extracranially at the level of the porus acusticus into the soft tissues of the neck (Fig, G–I; Video S1). No spinal CSF leak was demonstrated. The patient underwent a suboccipital craniotomy. Intraoperatively, the defect in the ventral wall of the porus acusticus could be palpated and dural substitute was placed within and around the defect. Headaches were unchanged and postoperative MRI showed mild improvement of brain sagging. If this procedure fails to correct the CSF leak long-term, then a subtotal petrosectomy and mastoidectomy is the next step.


A
B
C
D
E
F
G
H
I

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Case Report | Full Access

CSF-Venous Fistula of the Clival Skull Base: A Unique Case Study and Literature Review

Jordan K. Simmons MD, Wasiq Nadeem BS, Marcel M. Maya MD, Arthur W. Wu MD, Wouter I. Schievink MD, Adam N. Mamelak MD, Dennis M. Tang MD

First published: 08 September 2023 | https://doi.org/10.1002/lary.31032

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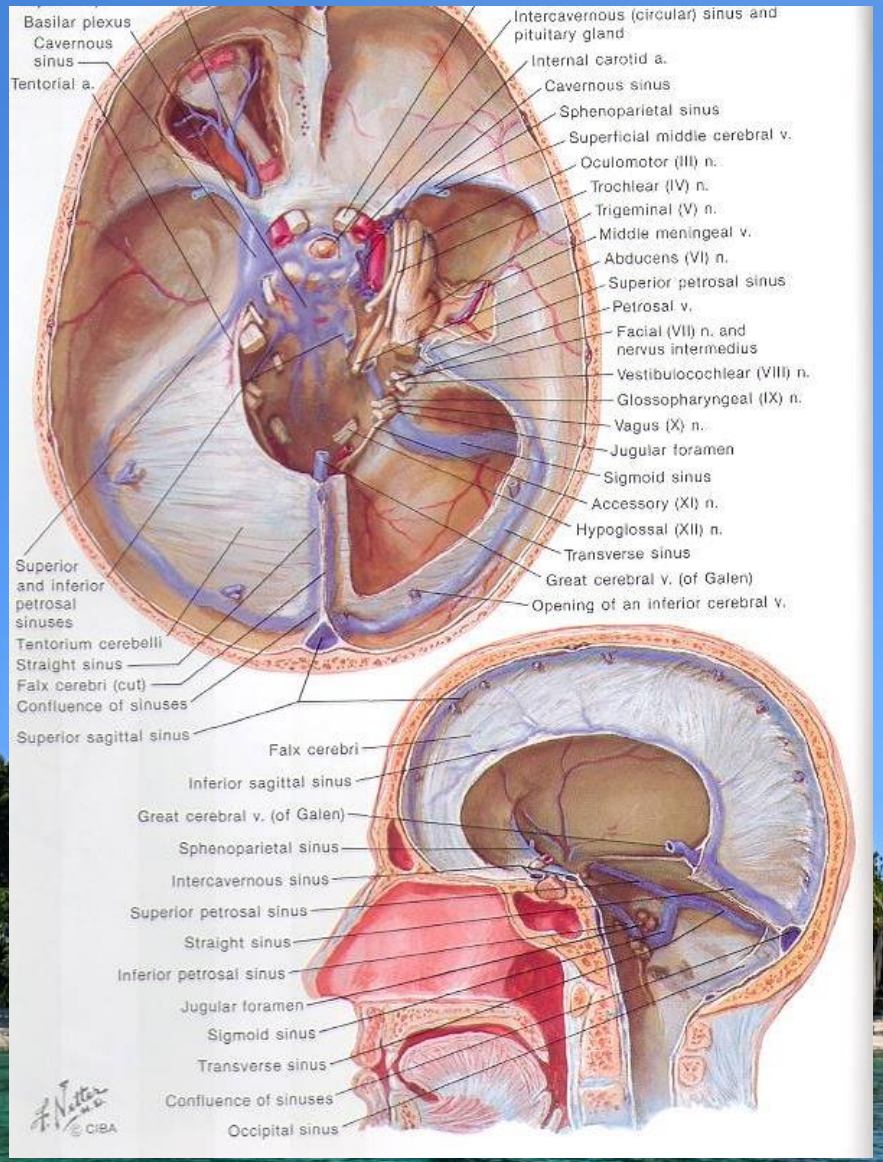
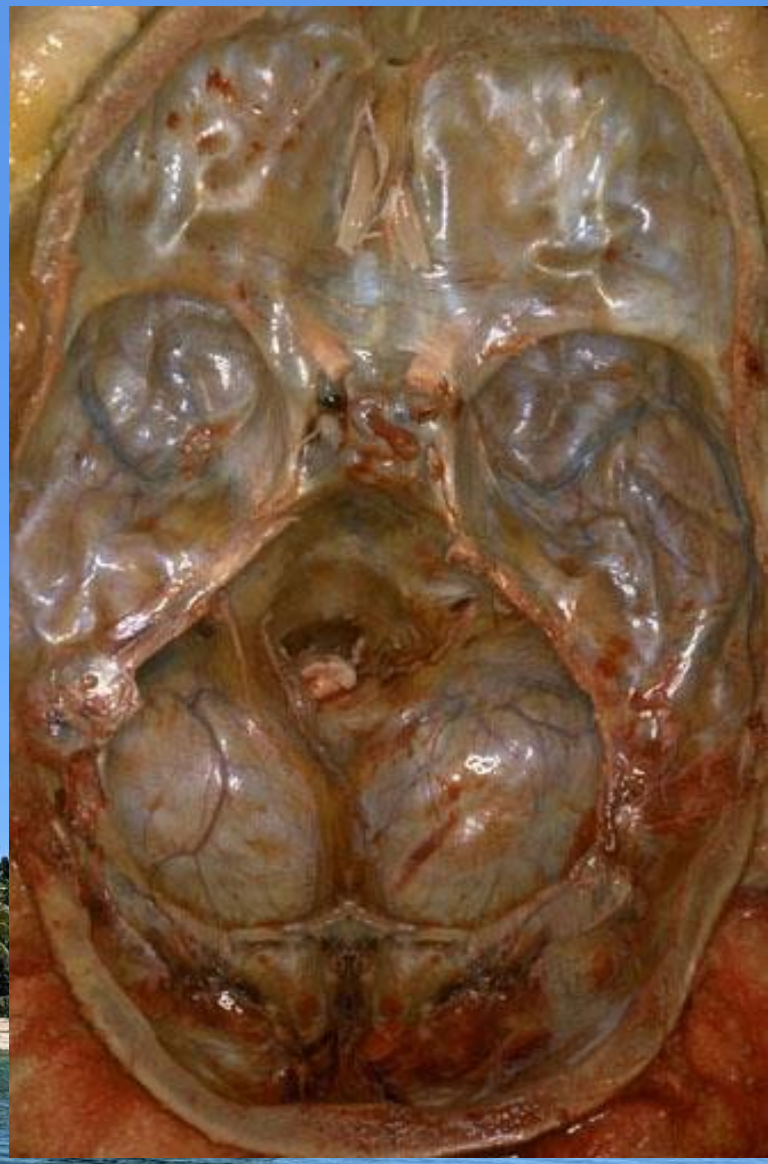
Abstract

An adolescent male presented with orthostatic headaches following head trauma. MRI showed cerebellar tonsil displacement and a bony defect in the clival skull base. Digital subtraction myelography (DSM) confirmed a cerebrospinal fluid-venous fistula (CVF). This was repaired endoscopically. CVFs cause uncontrolled flow of CSF into the venous system resulting in symptoms of intracranial hypotension. They're often difficult to identify on initial imaging. This is the first reported CVF originating in the central skull base, and the first treated via endoscopic trans-nasal approach. CVFs may elude initial imaging, making DSM crucial for unexplained spontaneous intracranial hypotension. *Laryngoscope*, 134:645–647, 2024

Overview

- Anterior fossa skull base
- Middle fossa
- Posterior fossa

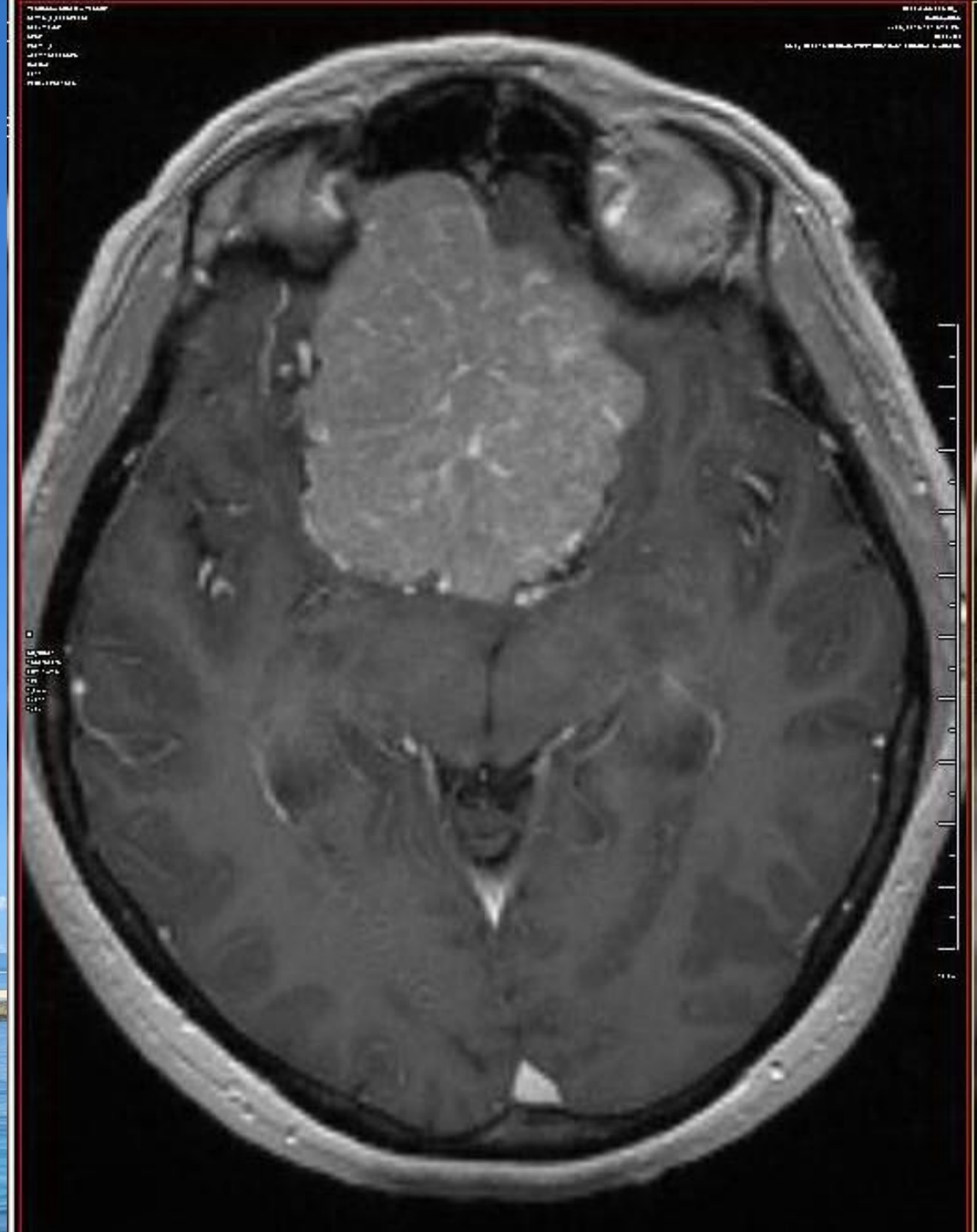


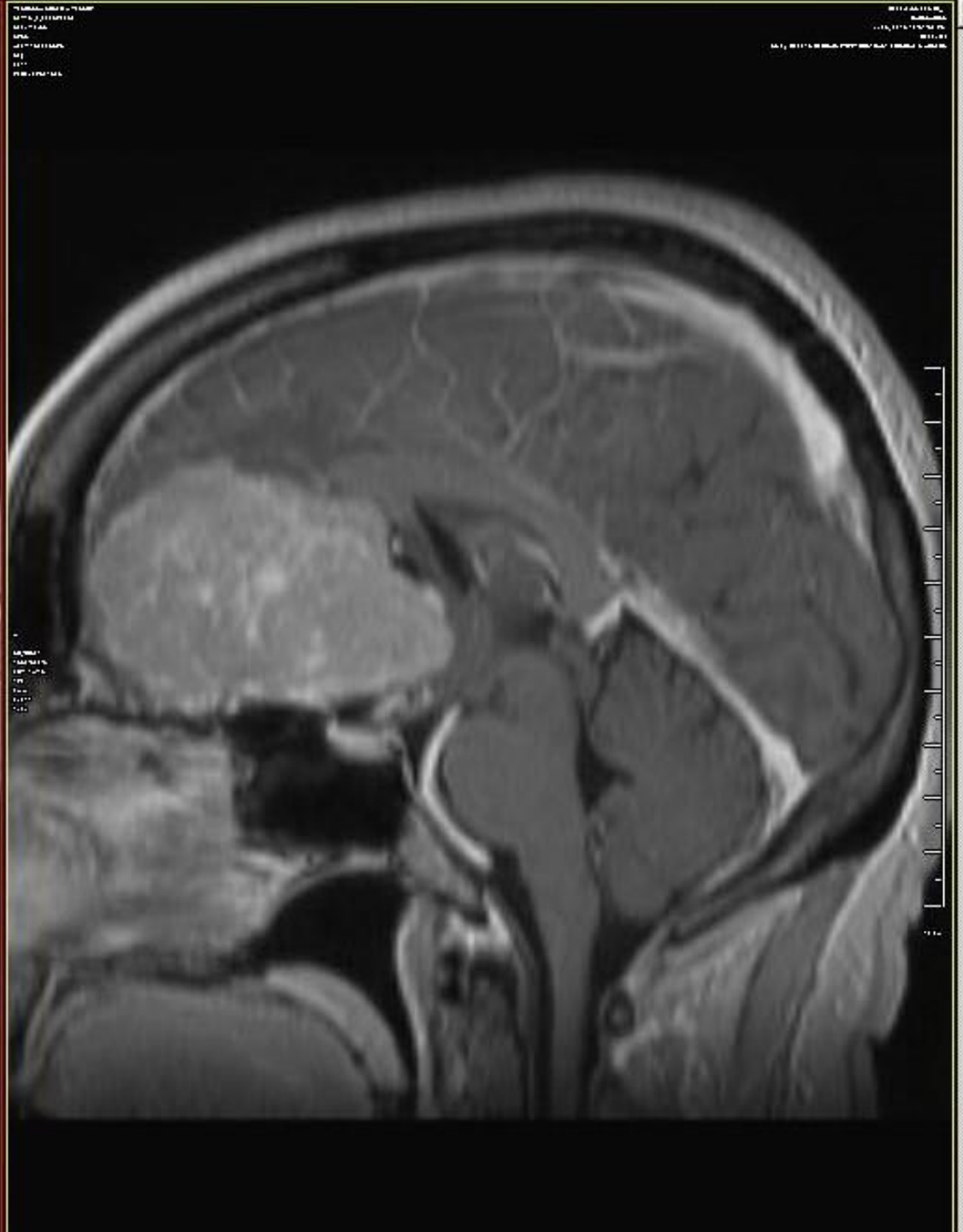


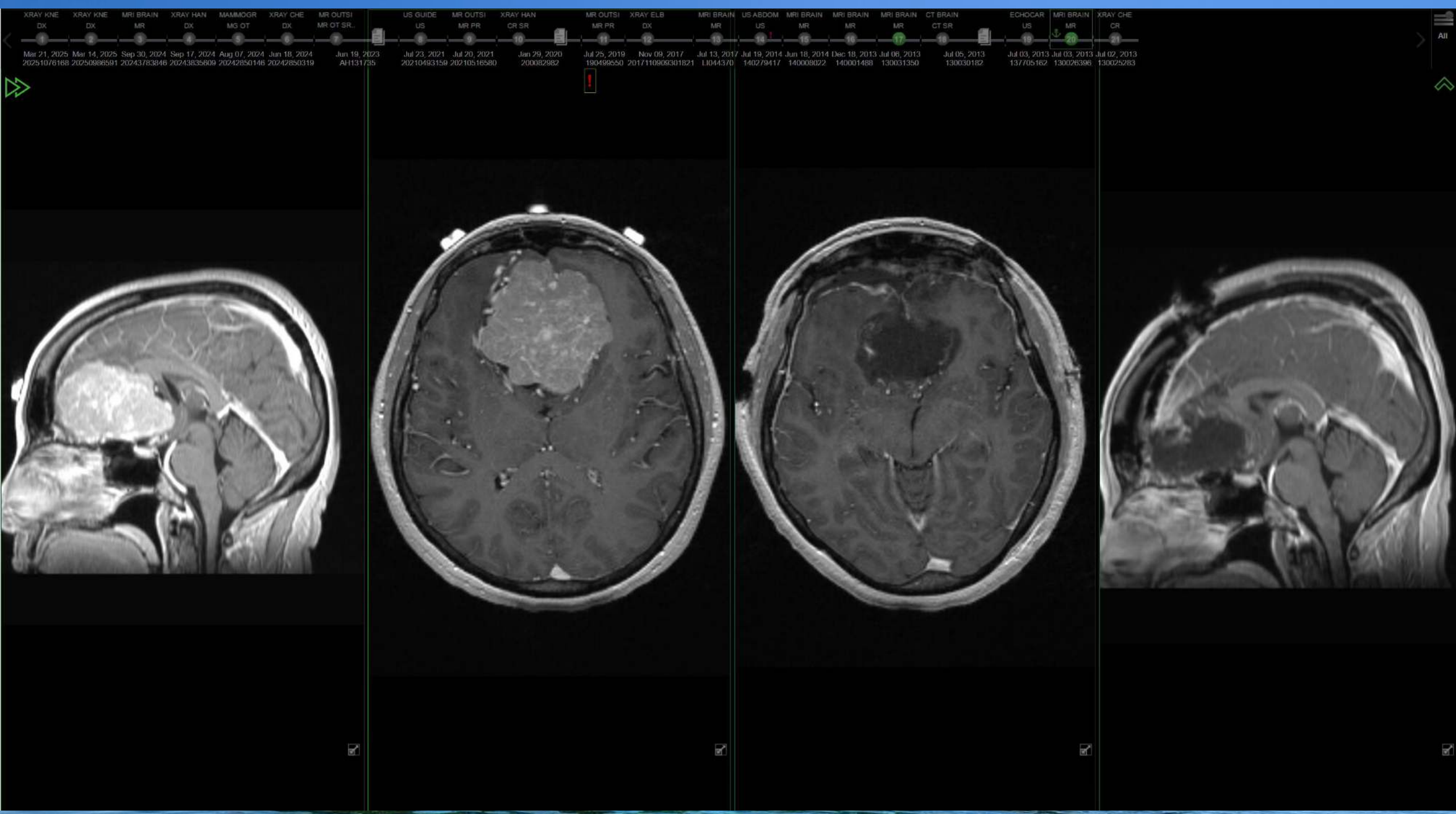
Anterior Fossa

- Frontal sinus
- Cribriform plate
- Ethmoid/ sphenoid sinuses

- 52 RH F w/ 2 y progressive depression
- Mult anti-depr. ECT?
- Depression vs abulia



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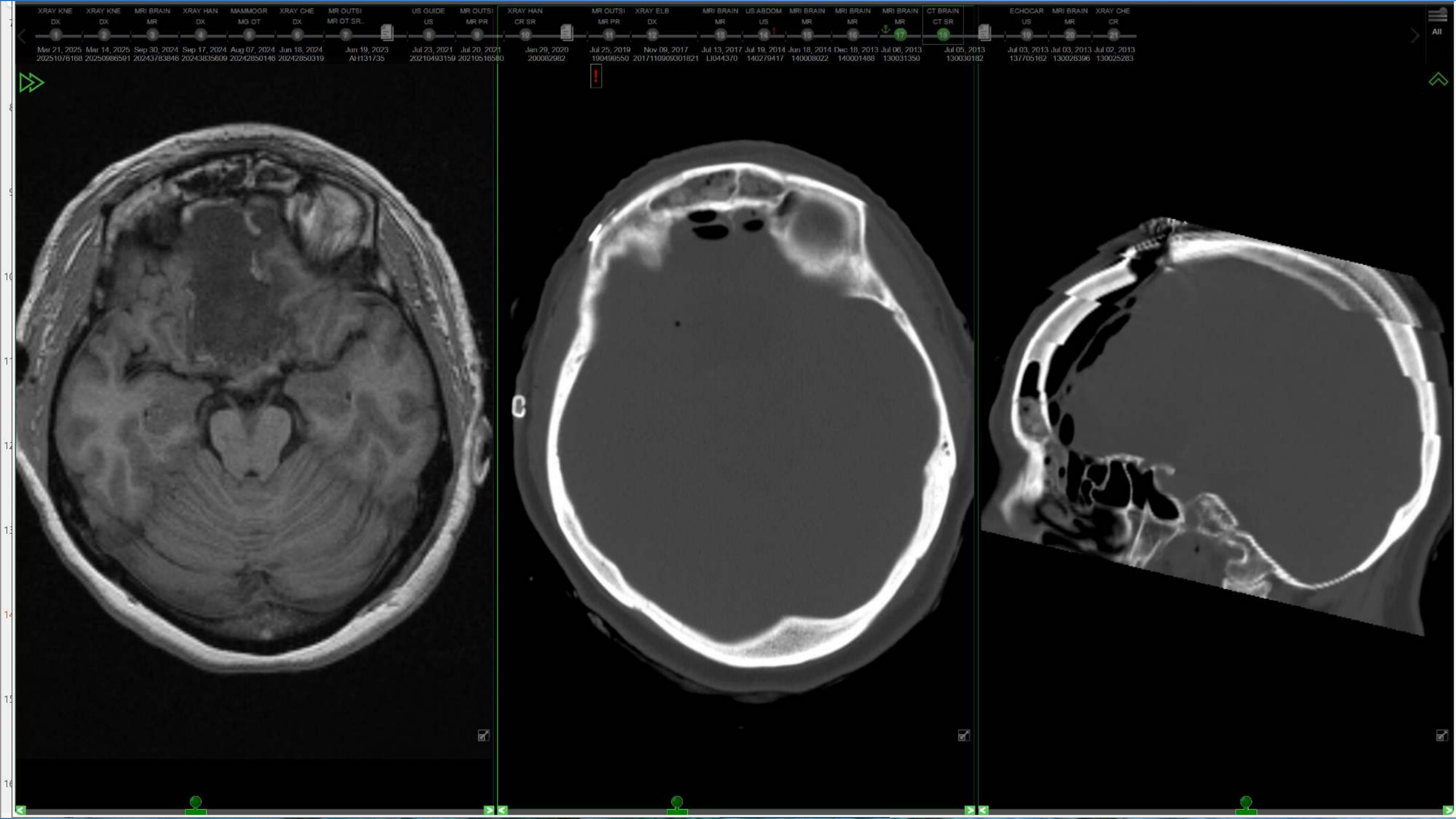
CT BRAIN CT SR 18 Jul 05, 2013 130030182
ECHOCAR US 19 Jul 03, 2013 13705162
MRI BRAIN MR 20 Jul 03, 2013 130026396
XRAY CHE CR 21 Jul 02, 2013 130025283
All

- Craniotomy across the frontal sinus
- Exenteration of sinus mucosa
- Abd fat graft
- Vascularized pericranial graft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MRI BRAIN MR 20 Jul 03, 2013 130026396
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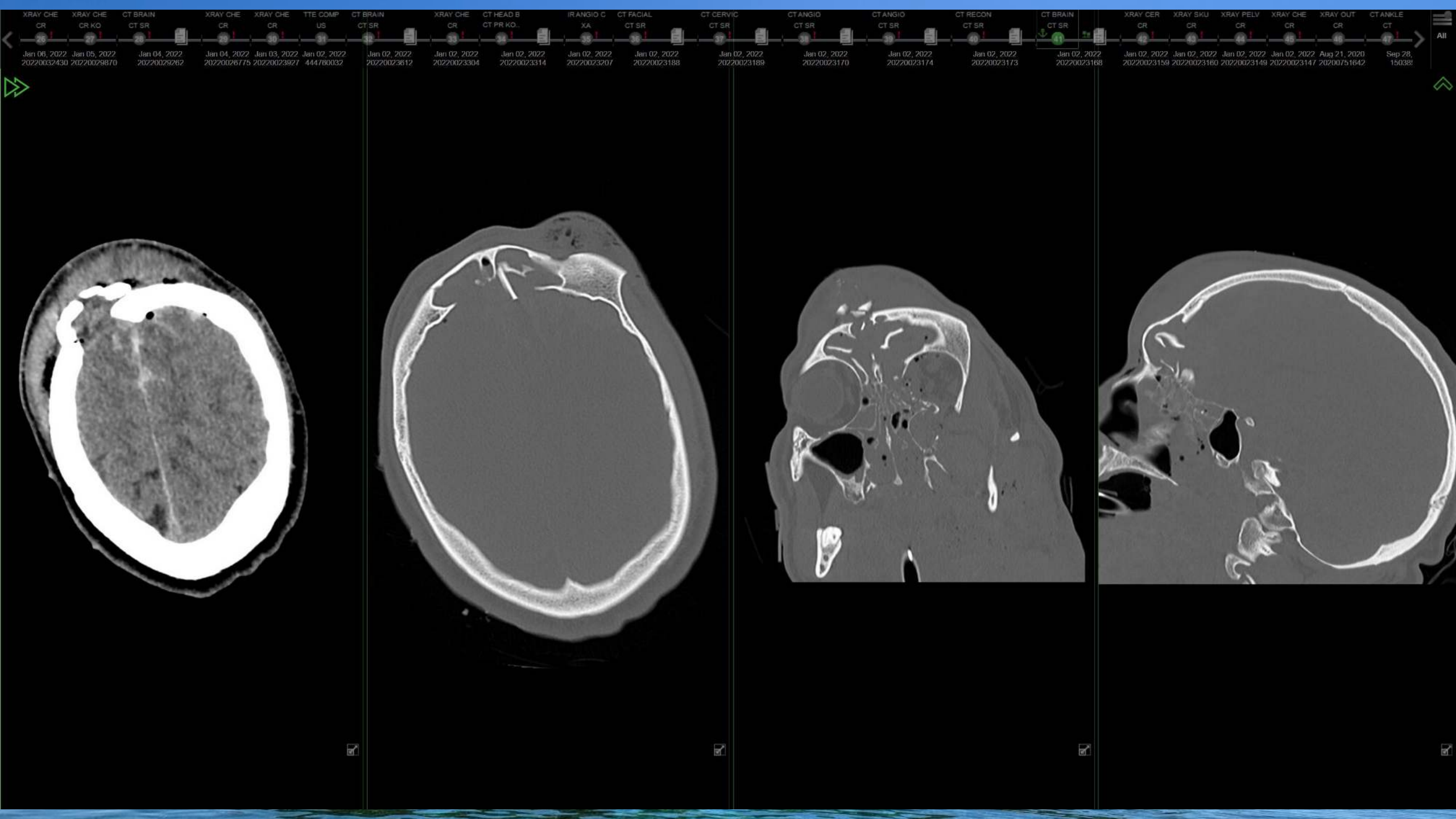
All
C

- 36 RH M s/p assault & GSW to anterior frontal lobe & scalp
- At first found confused and stumbling
- Quickly unresp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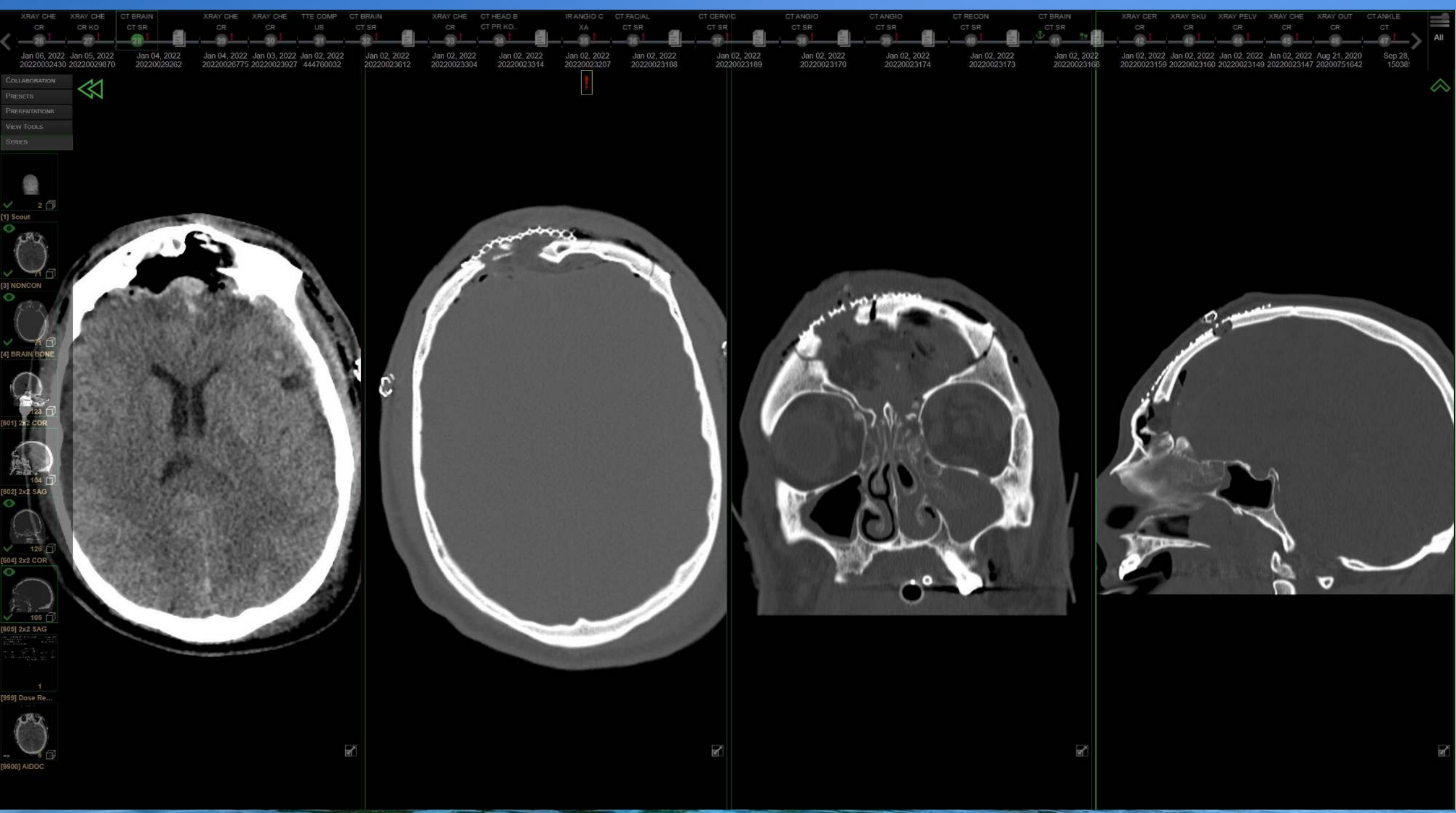
All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All
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View Tools
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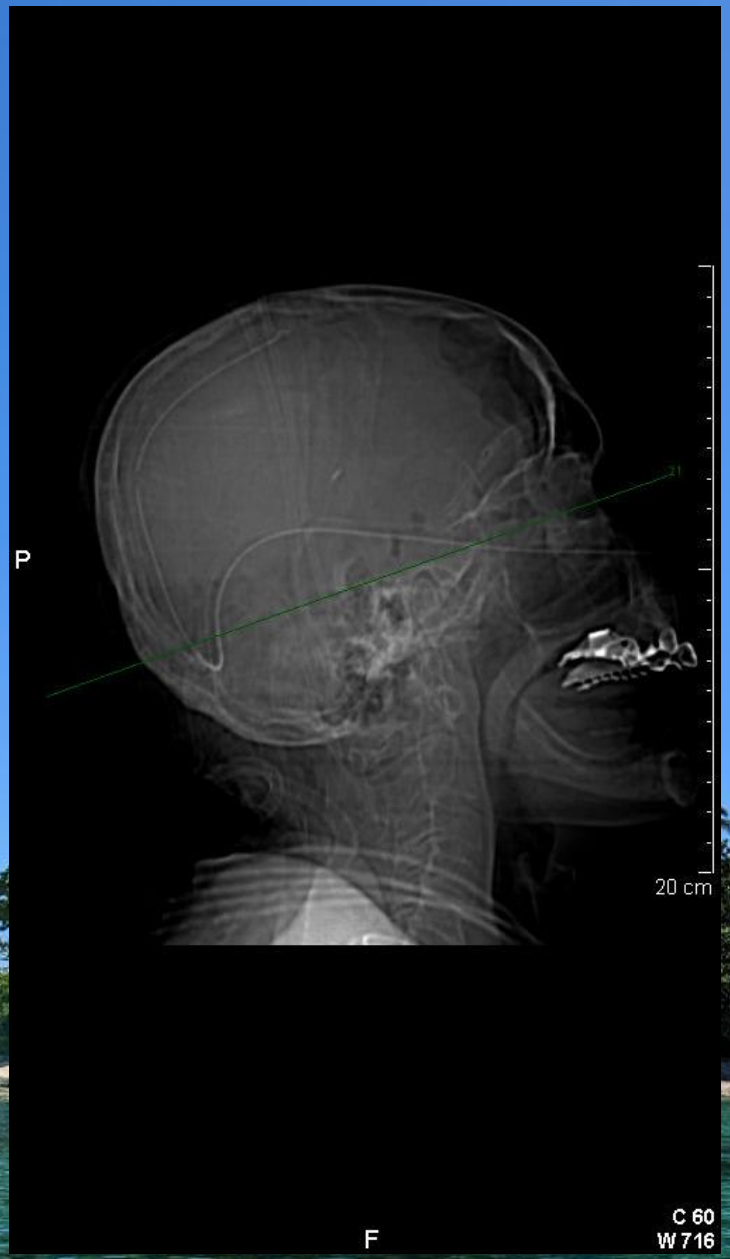
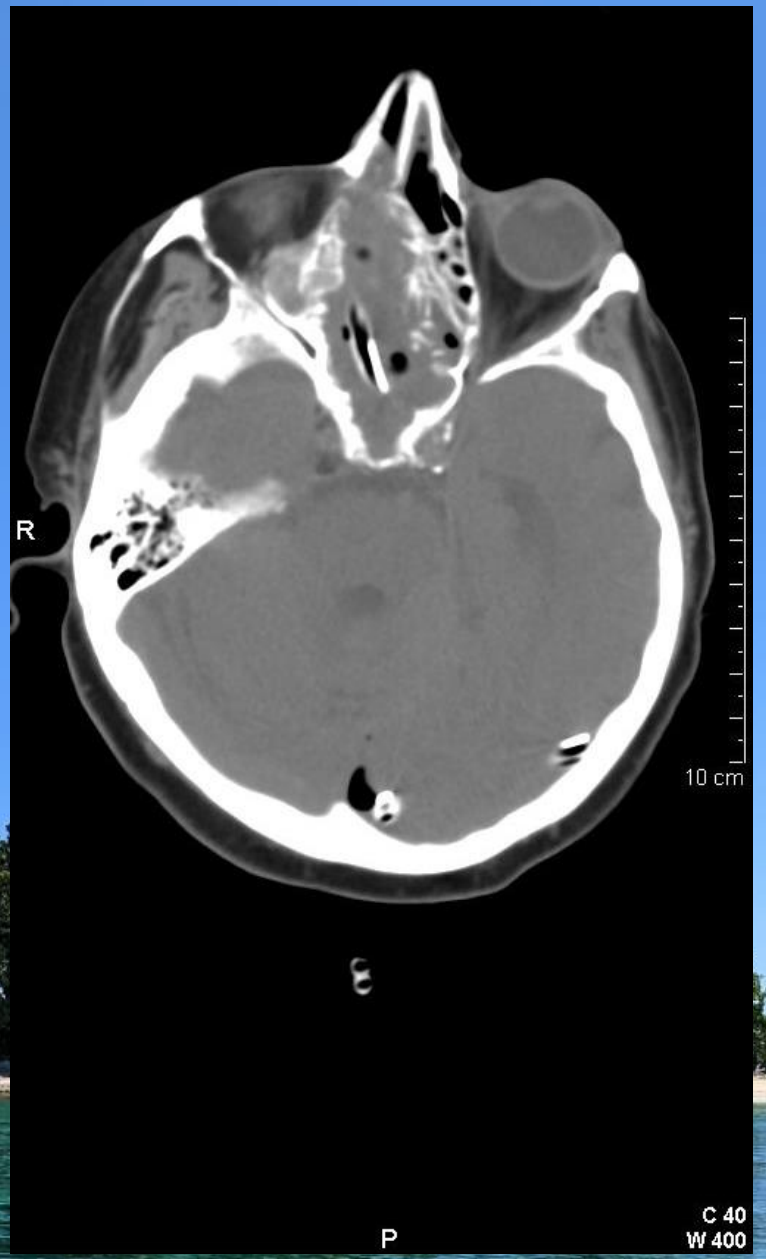
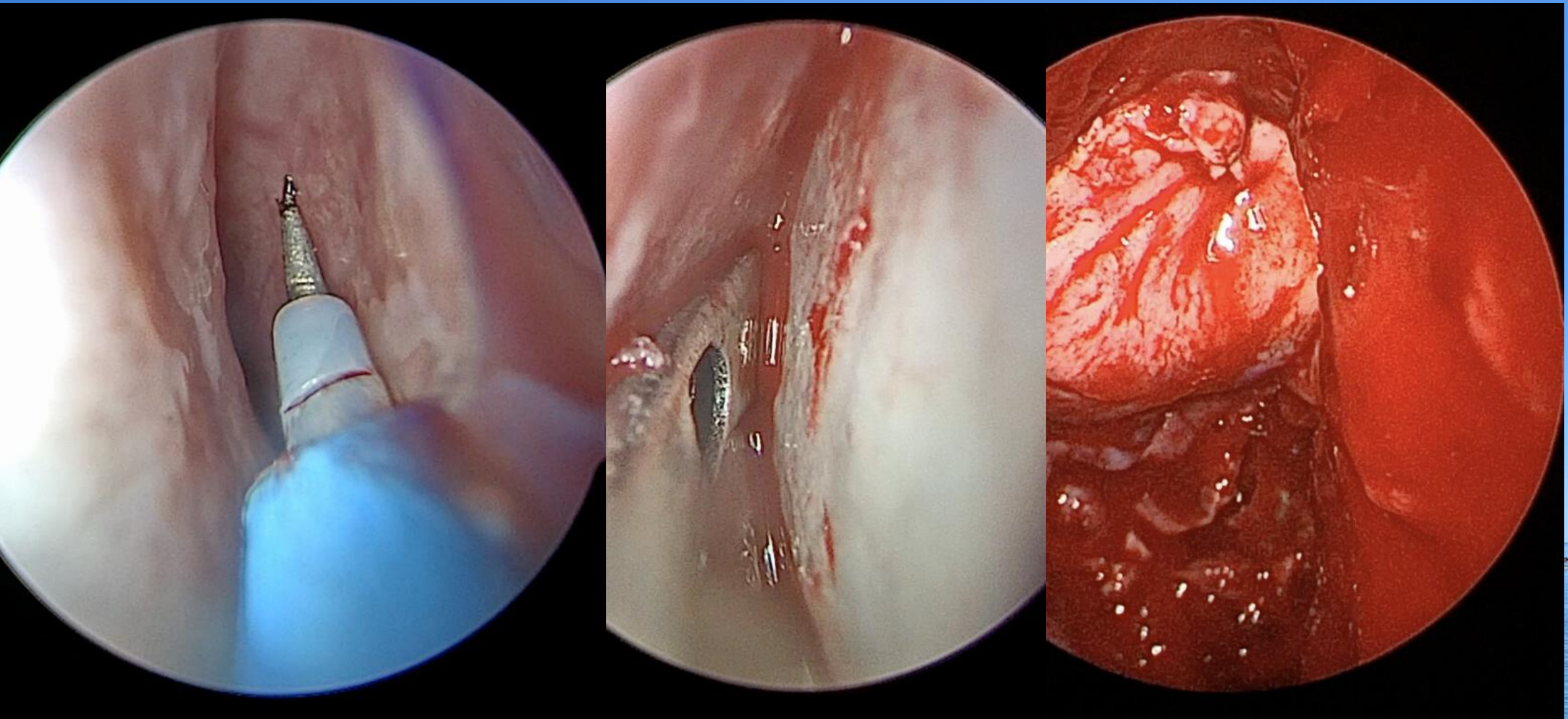

P
20 cm
F
C 60
W 716


R
10 cm
P
C 40
W 400

Endonasal surgery

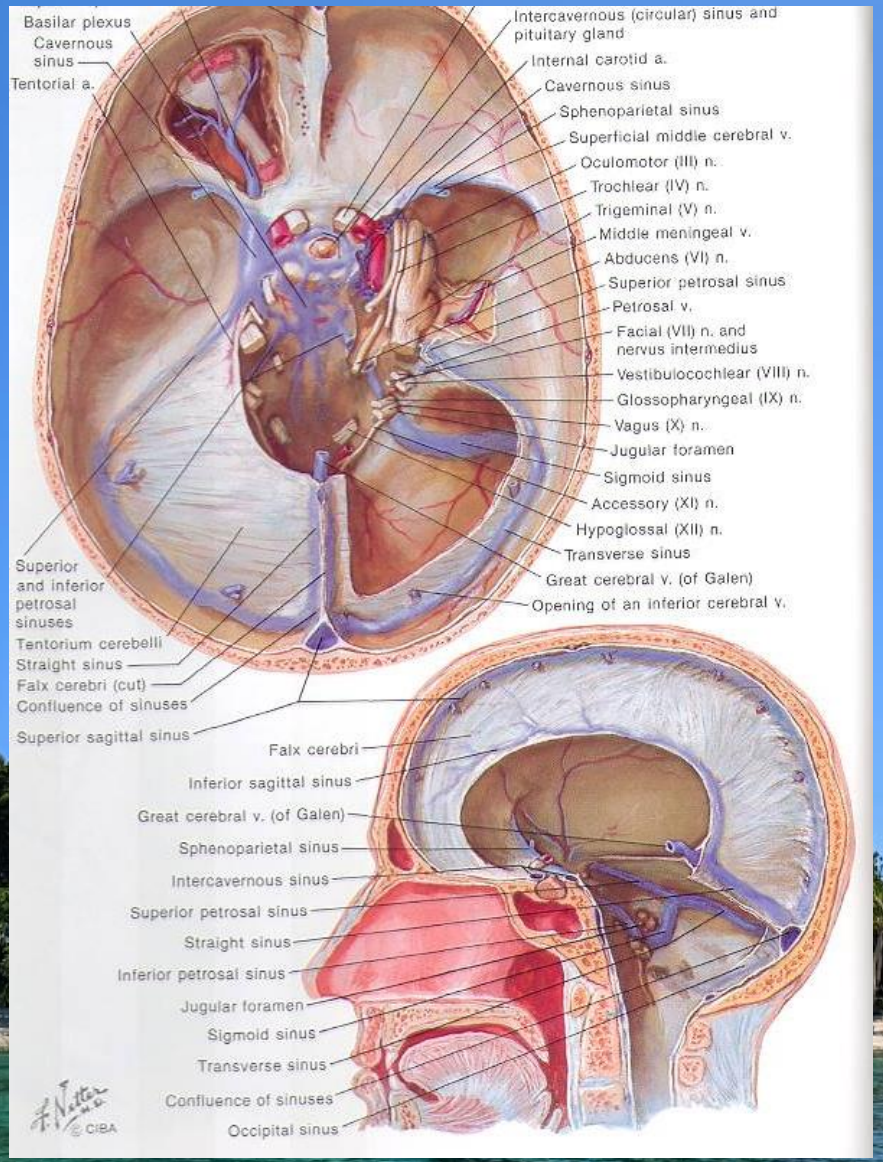
- Variations of expanded endonasal surgery
  - Transplanum
  - Transethmoid

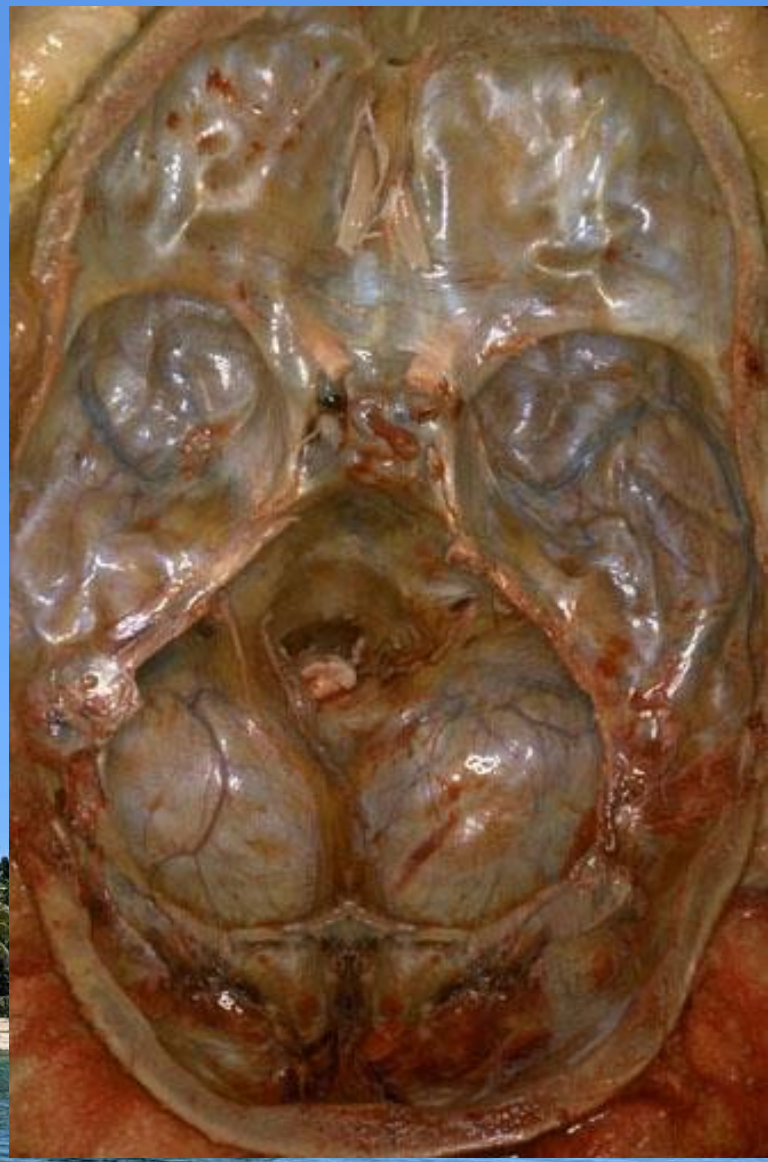
Nasoseptal Flap



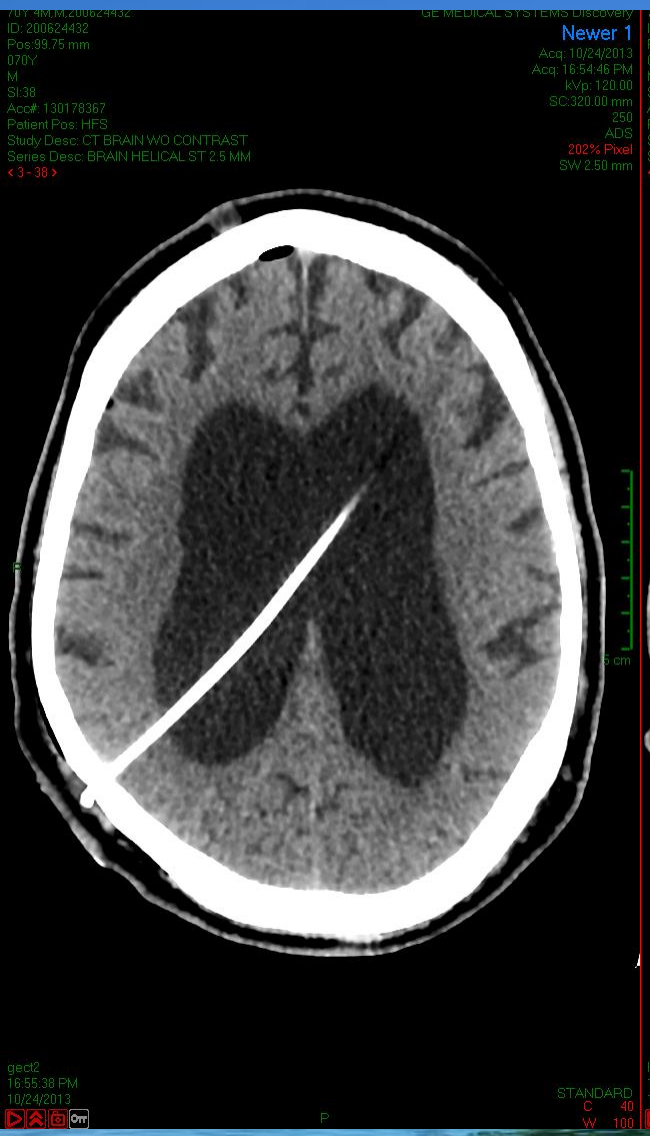
Middle Fossa

- Tegmen defects
  - Superior semicircular canal dehiscience (SSCD)
- Post-operative
- Post-traumatic





- 70 RH M from Maui w/ NPH
- OSH VPS but infection
- Repeat surgery 10/2013
- Mult episodes of spontaneous pneumoventricle after air travel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070Y
M
SI:38
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Patient Pos: HFS
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Series Desc: BRAIN HELICAL ST 2.5 MM
< 3 - 38 >
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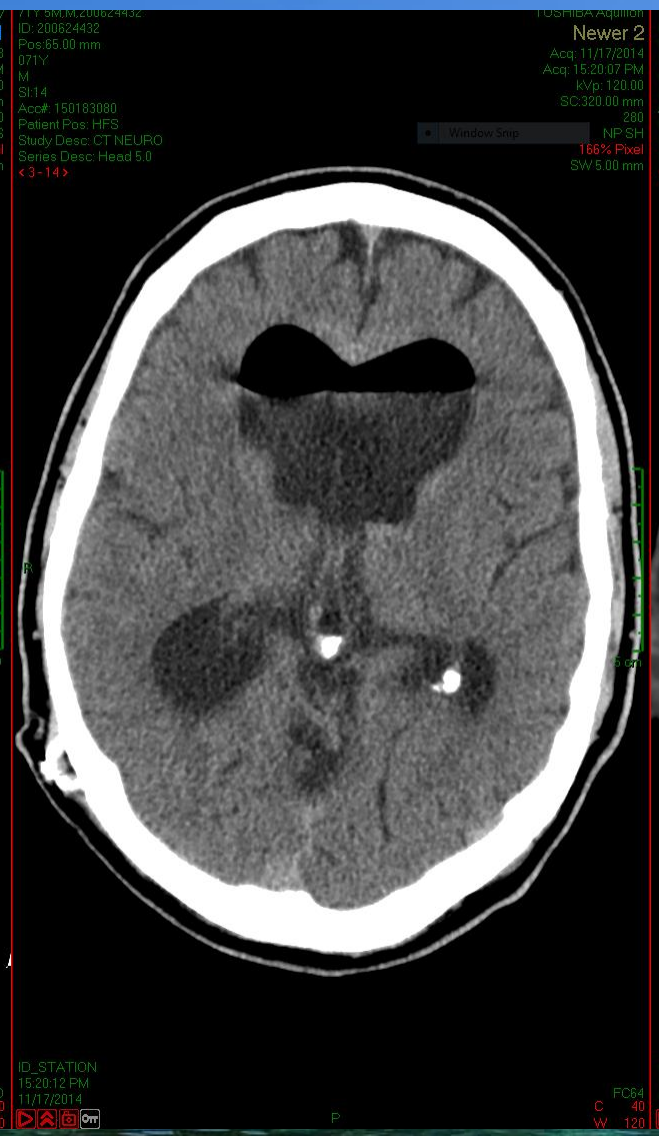
kVp: 120.00
SC:320.00 mm
250
ADS
202% Pixel
SW 2.50 mm
R
6 cm
gect2
16:55:38 PM
10/24/2013
STANDARD
C 40
W 100
P


TOSHIBA Aquilion
Newer 2
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Pos:65.00 mm
071Y
M
SI:14
Acc#: 150183080
Patient Pos: HFS
Study Desc: CT NEURO
Series Desc: Head 5.0
< 3 - 14 >
Acq: 11/17/2014
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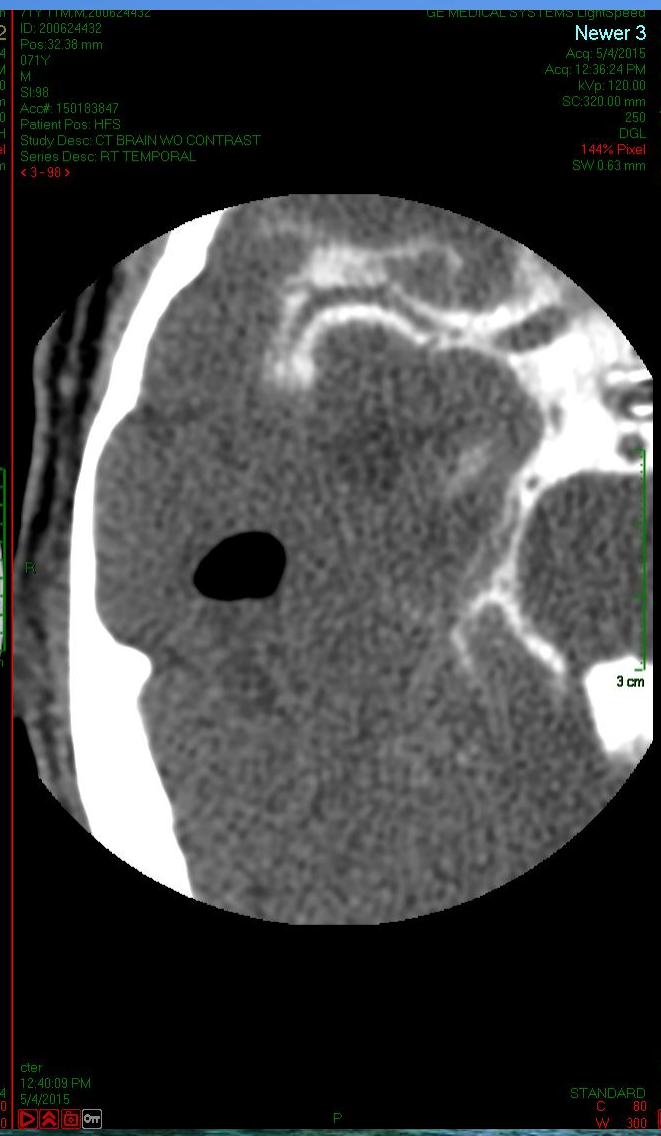
kVp: 120.00
SC:320.00 mm
280
NP SH
166% Pixel
SW 5.00 mm
R
6 cm
ID_STATION
15:20:12 PM
11/17/2014
FC64
C 40
W 120
P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M
SI:98
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Patient Pos: HFS
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Series Desc: RT TEMPORAL
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250
DGL
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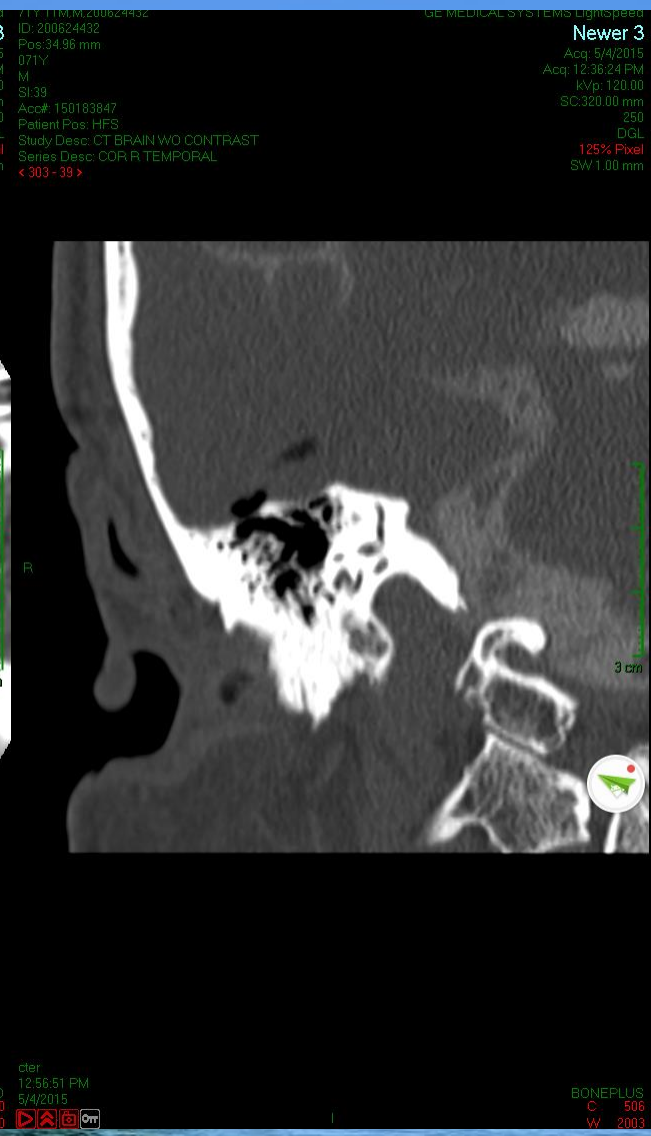
SW 0.63 mm
R
3 cm
cter
12:40:09 PM
5/4/2015
STANDARD
C 80
W 300
P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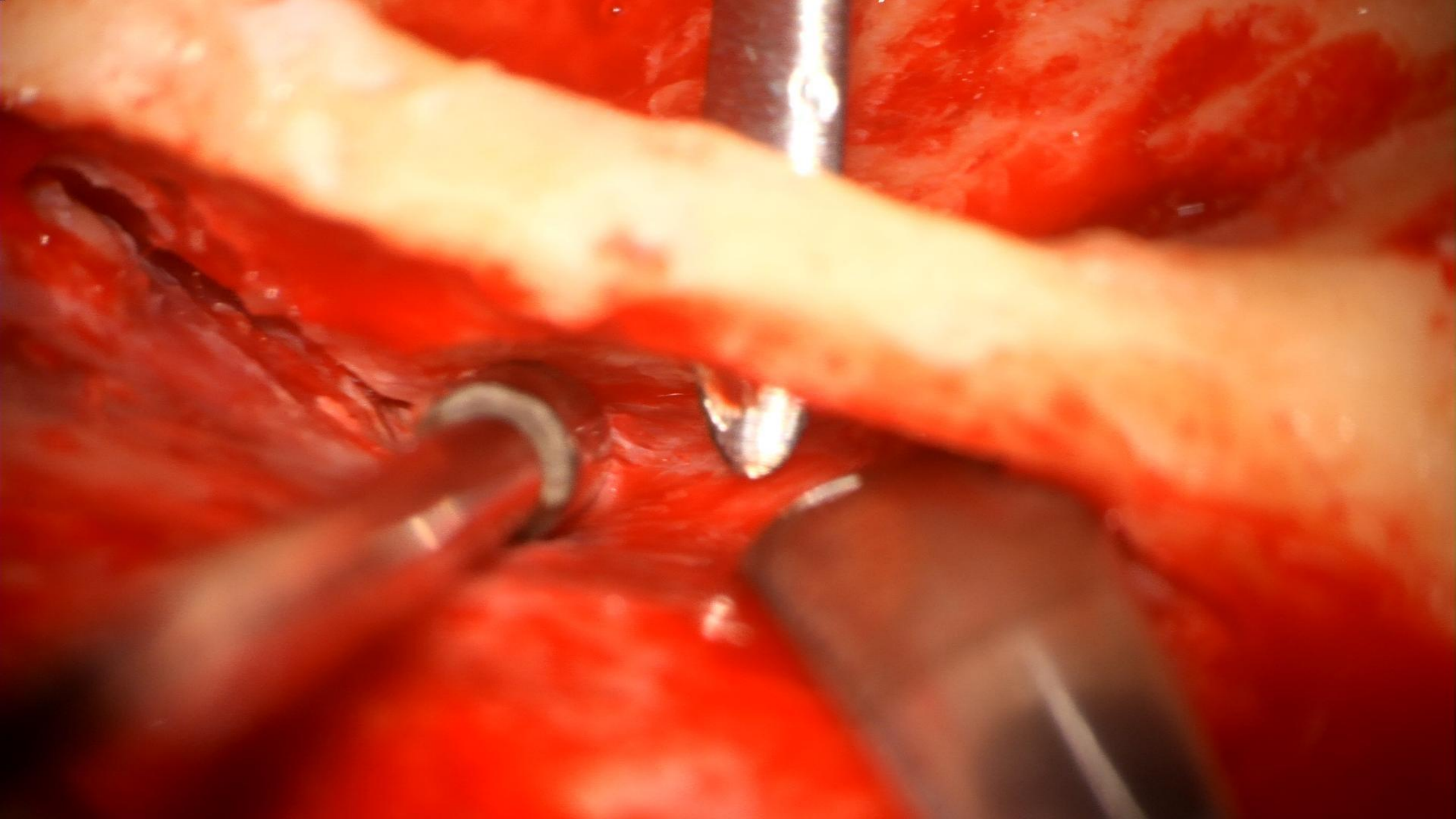
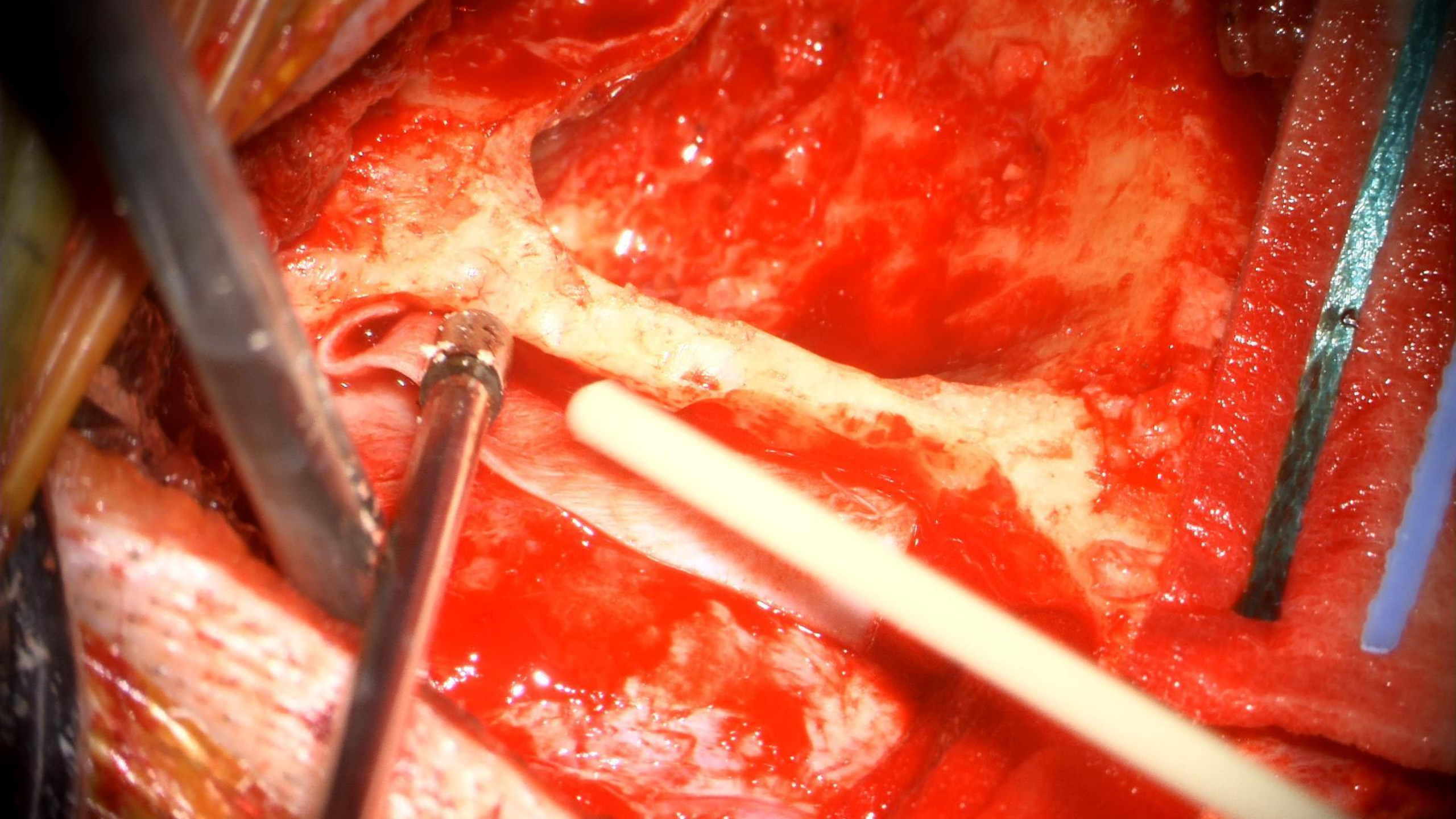
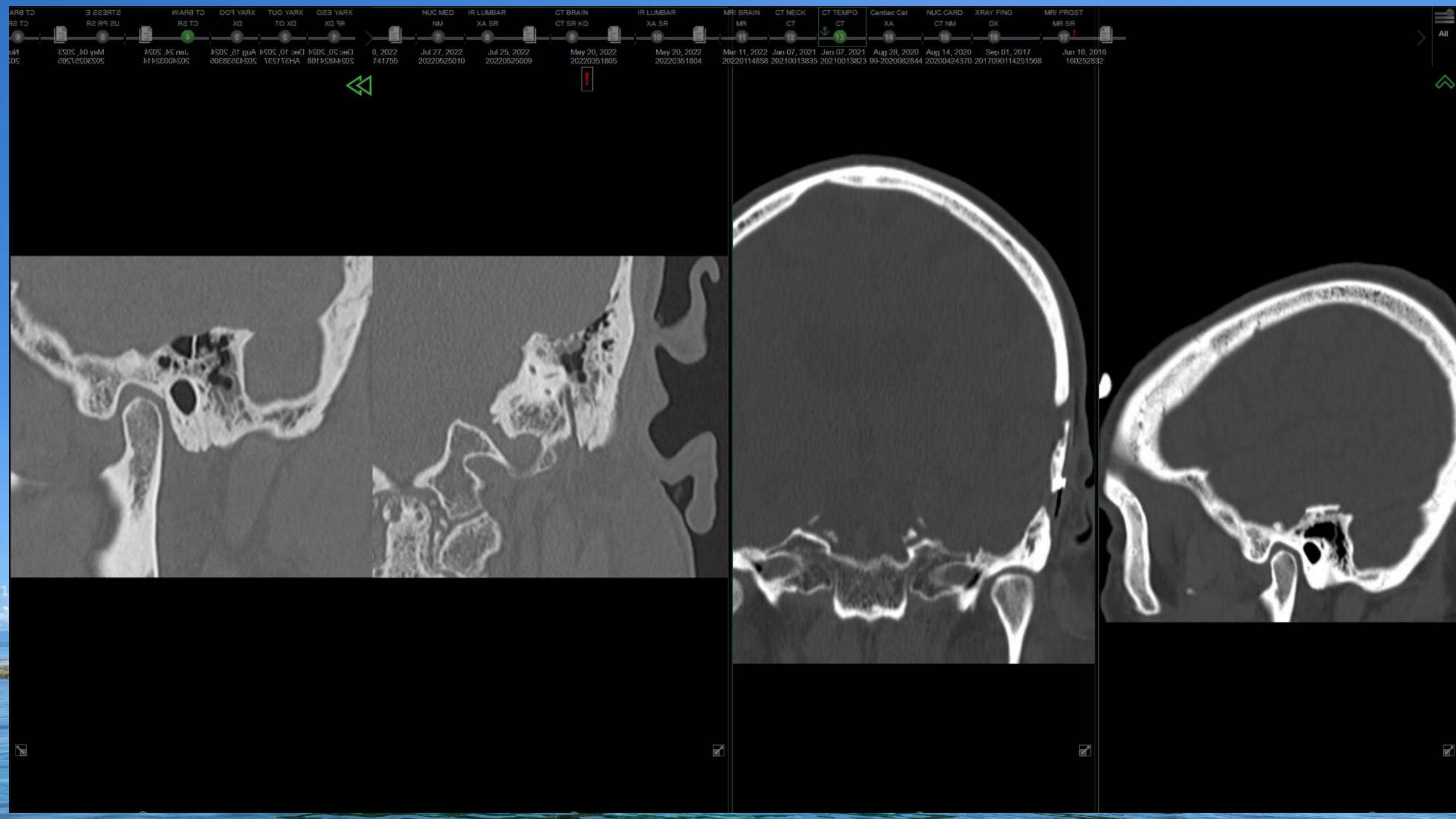
SC:320.00 mm
250
DGL
125% Pixel
SW 1.00 mm
R
3 cm
cter
12:56:51 PM
5/4/2015
BONEPLUS
C 506
W 2003
I

- Temporal craniotomy
- Autologous bone graft to middle fossa floor or bone cement
- Dural graft
- Dural sealant

- 74 RH M w/ L hearing loss
- Middle ear effusion
- PE tube- CSF



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Jul 27, 2022
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CT SR KO
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IR LUMBAR
XA SR
May 20, 2022
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MRI BRAIN
MR
May 20, 2022
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CT NECK
CT
Mar 11, 2022
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CT
Jan 07, 2021
20210013835
Cardiac Cat
XA
Jan 07, 2021
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NUC CARD
CT NM
Aug 28, 2020
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XRAY FING
DX
Aug 14, 2020
20200424370
MRI PROST
MR SR
Sep 01, 2017
20170901142515 68
Jun 16, 2016
160252832
All

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Spontaneous Pneumocephalus Due to Skull Base Defect a Spinal Cerebrospinal Fluid-Venous Fistula

Simon A. Menaker MD, Gregory P. Lekovic MD, PhD, Wouter I. Schievink MD

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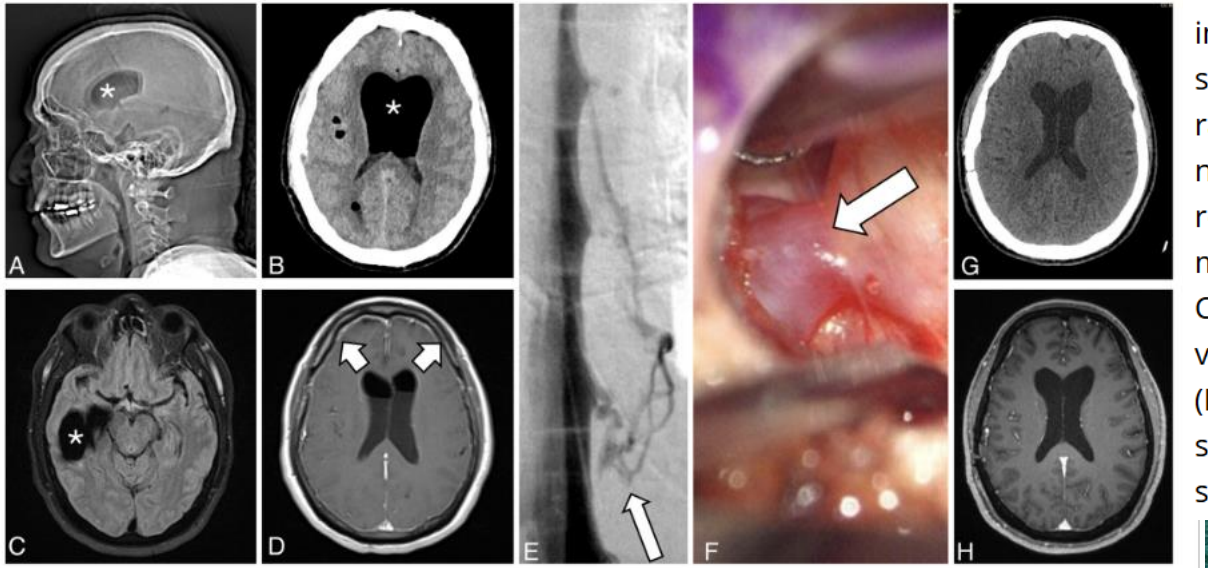
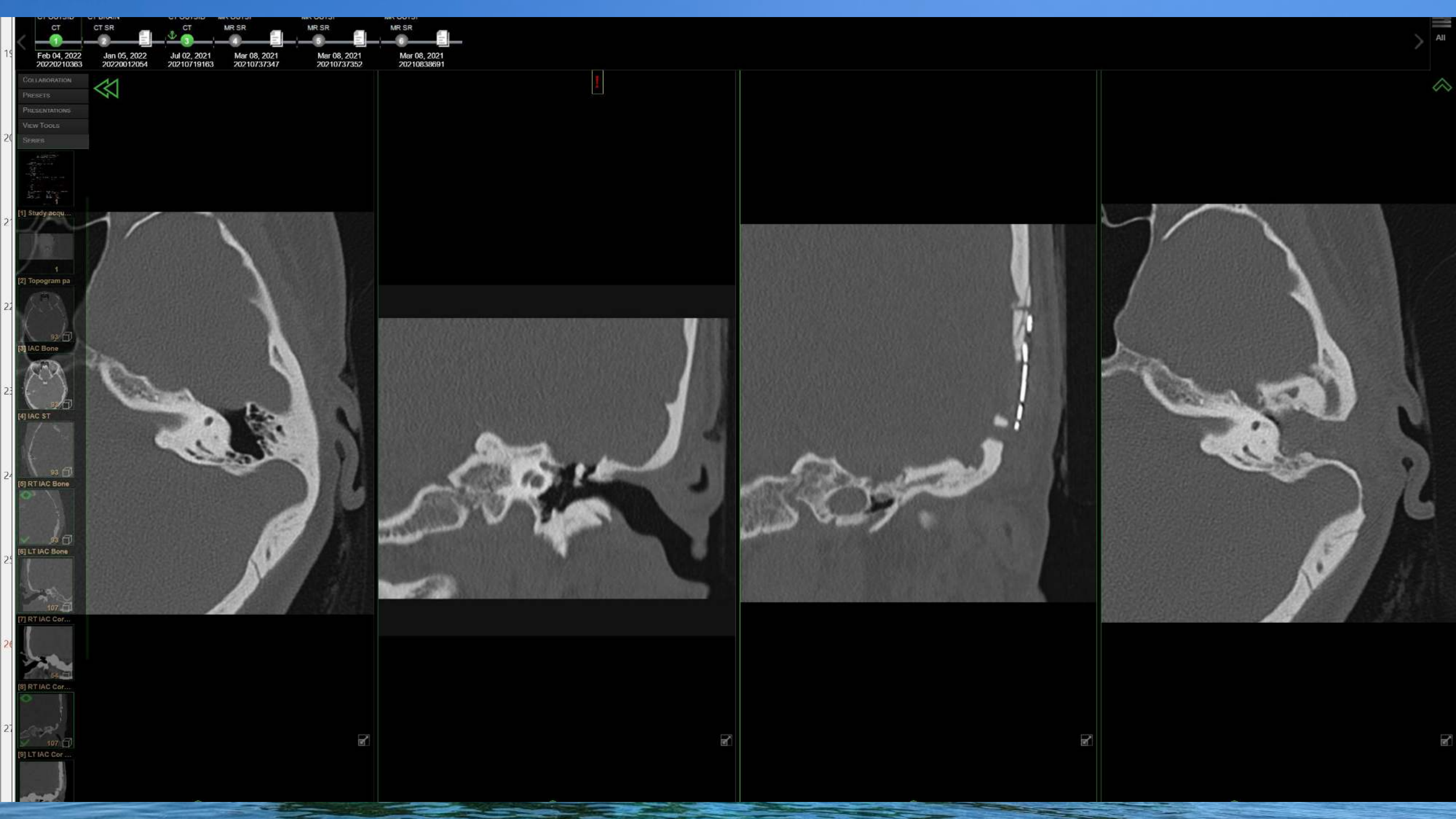


A 56-year-old man presented to an outside institution with sudden onset confusion, right otalgia, and left facial droop after a 1-month history of holocephalic orthostatic headaches. There was no history of trauma or otorrhea. Computed tomography (CT) and magnetic resonance imaging (MRI) showed diffuse pachymeningeal enhancement and pneumocephalus involving the ventricles, subarachnoid spaces, and brain parenchyma (Fig 1A–D). Cerebral abscess was suspected based on the combination of an air pocket within the right temporal lobe and the presence of meningeal enhancement. He underwent a craniotomy, but intraoperatively no abscess was identified, and biopsy showed normal brain tissue. Gram stain and cultures were negative. Postoperatively he had multiple short-interval readmissions for altered mental status with imaging at each presentation demonstrating persistent or worsening pneumocephalus. Eventually, he was found to have right tegmen mastoideum defect on CT. Through a middle fossa approach, a large defect in the right tegmen mastoideum was identified and this was repaired. Serial postoperative imaging demonstrated persistent pneumocephalus. Intracranial pressure monitoring showing pressures between −2 and −15mmHg and the presence of brain sagging on MRI raised concern for an underlying cerebrospinal fluid (CSF) leak. The patient underwent nontargeted large volume epidural blood patching without improvement. Magnetic resonance (MR)- and conventional CT-myelography demonstrated multiple thoracic meningeal diverticula, but no CSF leak. Digital subtraction myelography revealed a right T11 CSF-venous fistula (Fig 1E). The patient underwent an uneventful foraminotomy and a CSF-venous fistula was identified along the inferior surface of the proximal nerve root sleeve (Fig 1F). The fistula was ligated with a Yasargil titanium aneurysm clip. One month after surgery the patient was asymptomatic, neurologic examination was normal, and imaging showed complete resolution of pneumocephalus (Fig 1G, H).

SSCD

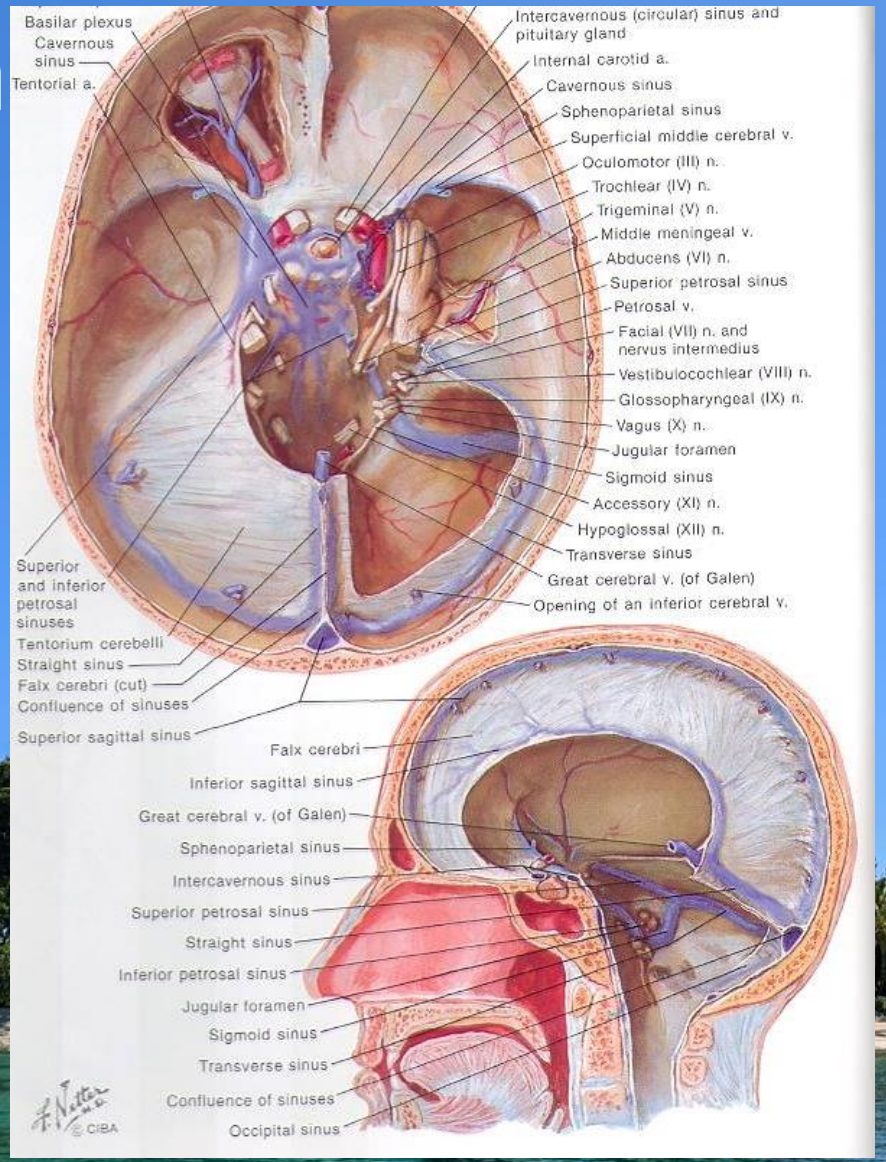
- Superior semicircular canal dehiscence syndrome
- Vertigo or dizziness
- Hearing loss
- Unusual sounds
- Sound sensitivity

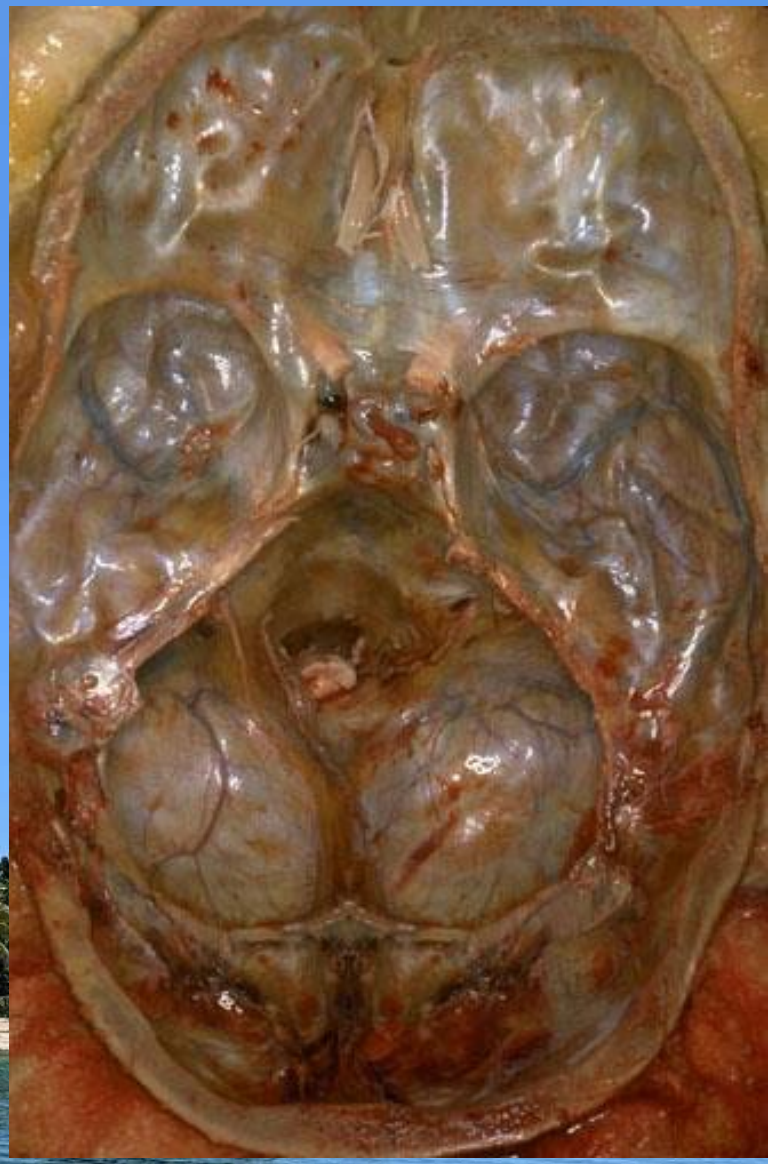
- 27 F w/ L pulsatile tinnitus & muffled hearing
- Mimicked her heartbeat but louder


CT
CT SR
CT
MR SR
MR SR
MR SR
Feb 04, 2022
20220210363
Jan 05, 2022
20220012054
Jul 02, 2021
20210719163
Mar 08, 2021
20210737347
Mar 08, 2021
20210737352
Mar 08, 2021
20210838691
All
Collaboration
Presets
Presentations
View Tools
Series
[1] Study acqu...
[2] Topogram pa
[3] IAC Bone
[4] IAC ST
[6] RT IAC Bone
[6] LT IAC Bone
[7] RT IAC Cor...
[8] RT IAC Cor...
[9] LT IAC Cor ...

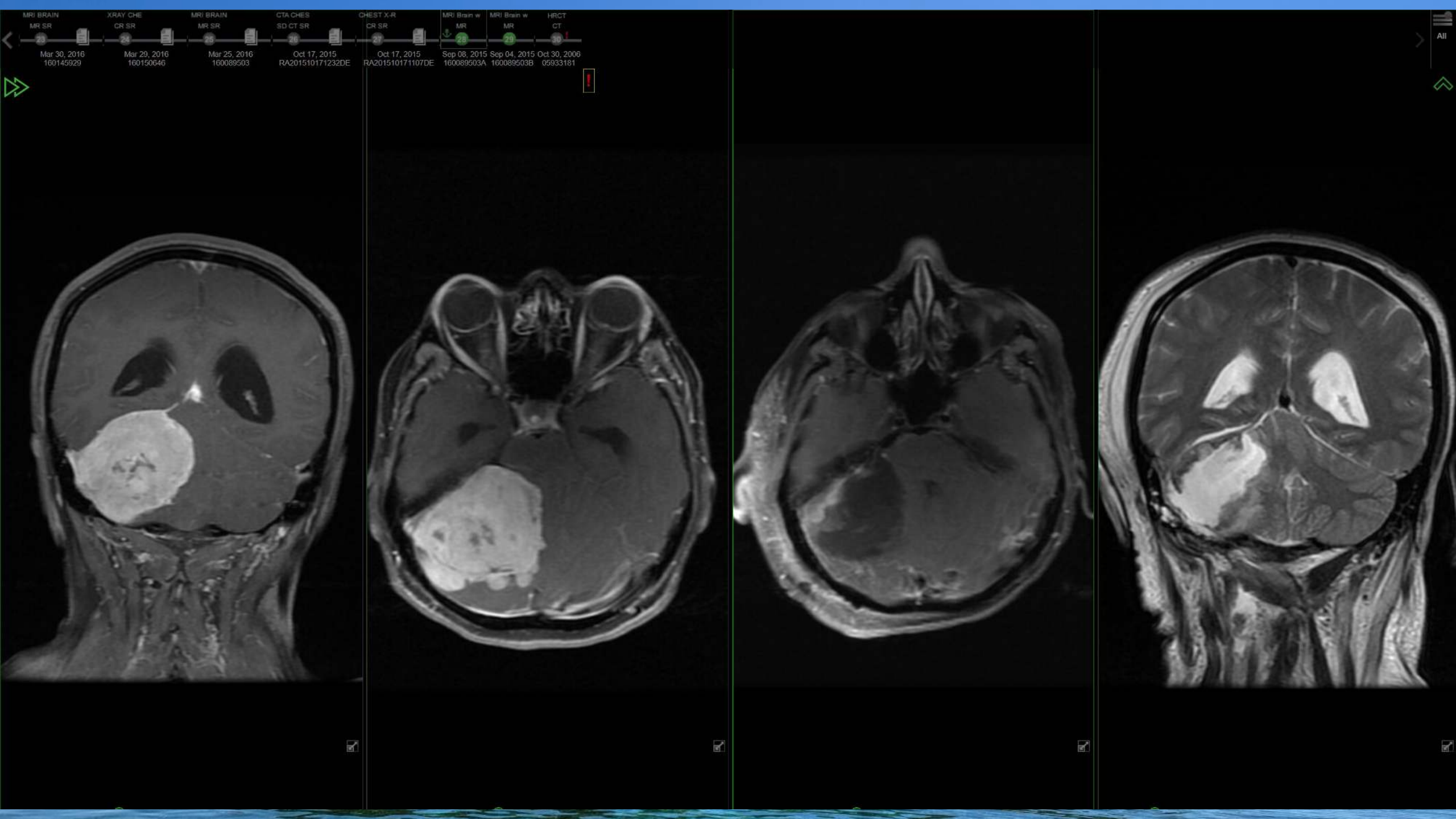
Posterior Fossa

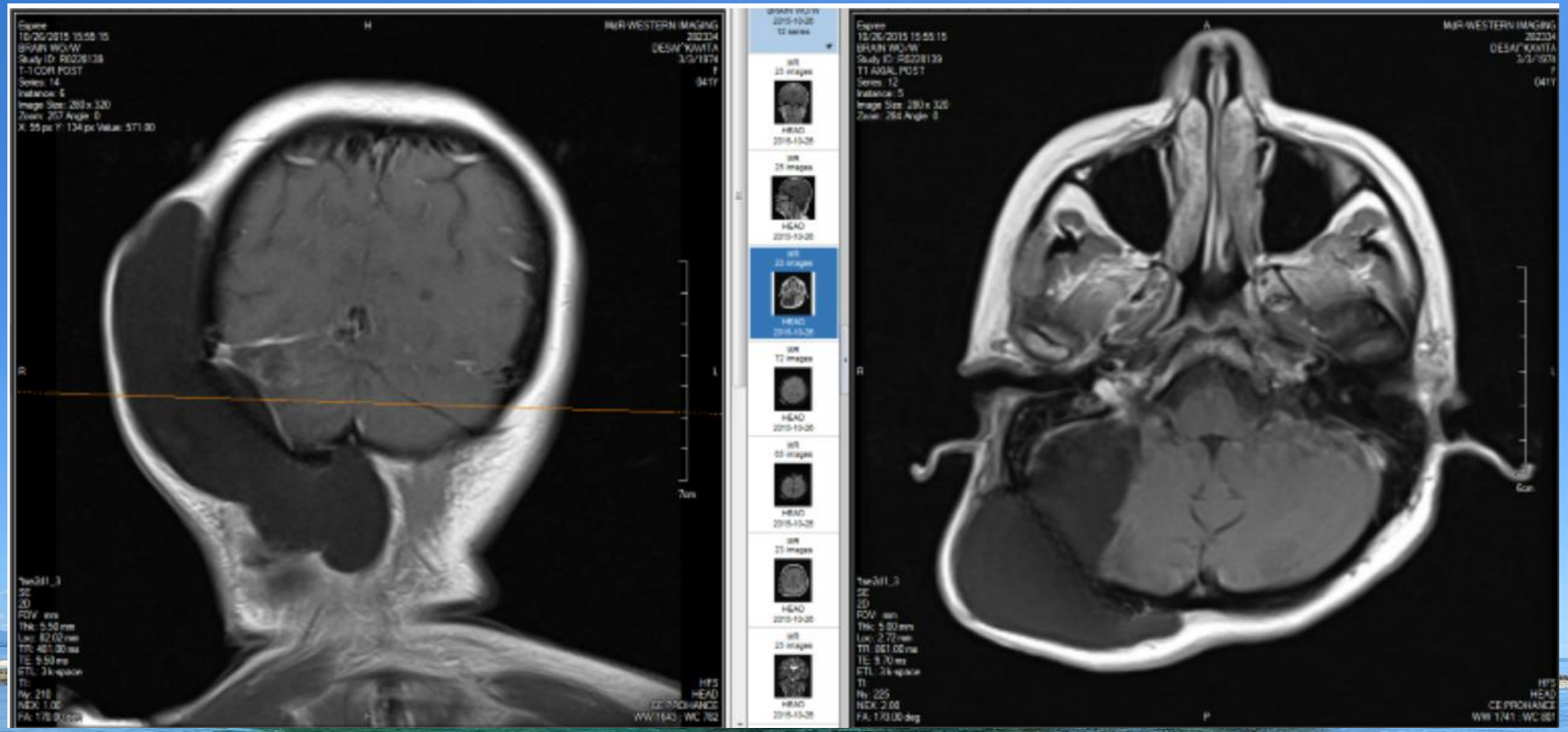
- Few spontaneous pathologies
- Post-operative
- Chiari malformation

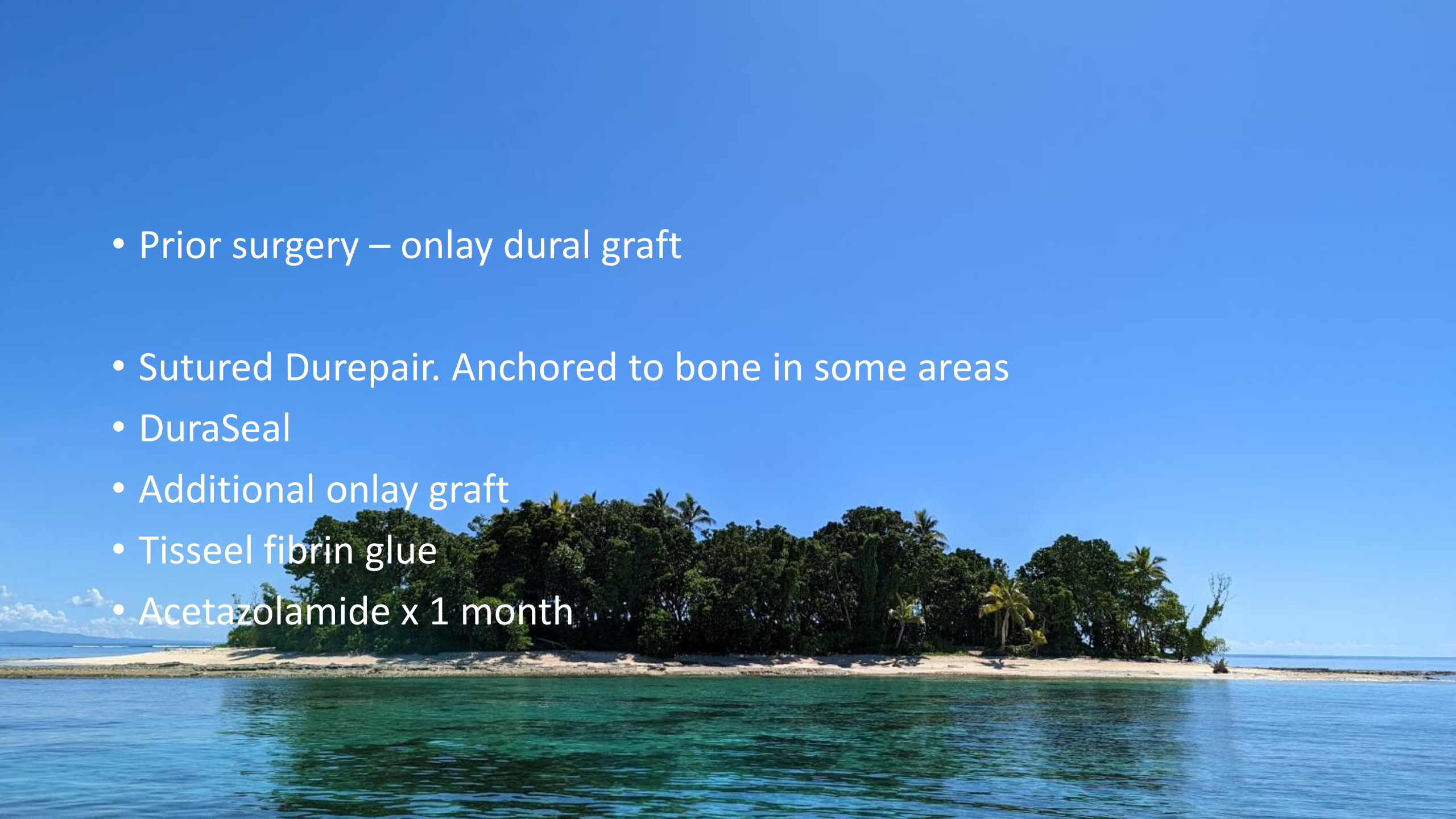




- 41 RH F w/ diplopia & blurry vision

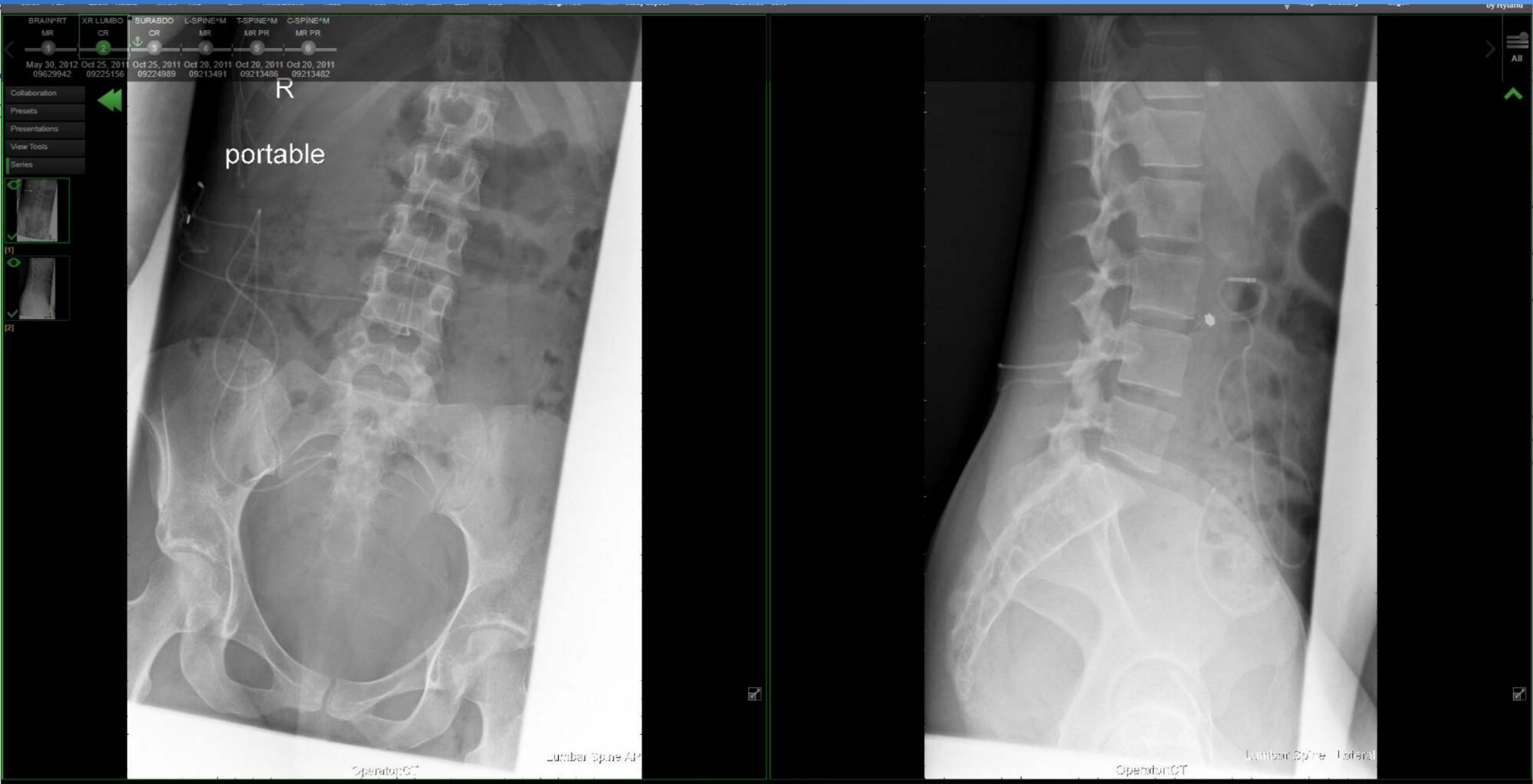

MRI BRAIN
MR SR
23
Mar 30, 2016
160145929
XRAY CHE
CR SR
24
Mar 29, 2016
160150646
MRI BRAIN
MR SR
25
Mar 25, 2016
160089503
CTA CHES
SD CT SR
26
Oct 17, 2015
RA201510171232DE
CHEST X-R
CR SR
27
Oct 17, 2015
RA201510171107DE
MRI Brain w
MR
28
Sep 08, 2015
160089503A
MRI Brain w
MR
29
Sep 04, 2015
160089503B
HRCT
CT
30
Oct 30, 2006
05933181
All


Espree
10/26/2015 15:55:15
BRAIN WO/W
Study ID: R0228139
T1 AXIAL POST
Series: 12
Instance: 5
Image Size: 280 x 320
Zoom: 266 Angle: 0
M&R WESTERN IMAGING
202334
DESAI^KAVITA
3/3/1974
F
041Y
R
A
P
HFS
HEAD
CE PROHANCE
WW 1741 : WC 881
HEAD

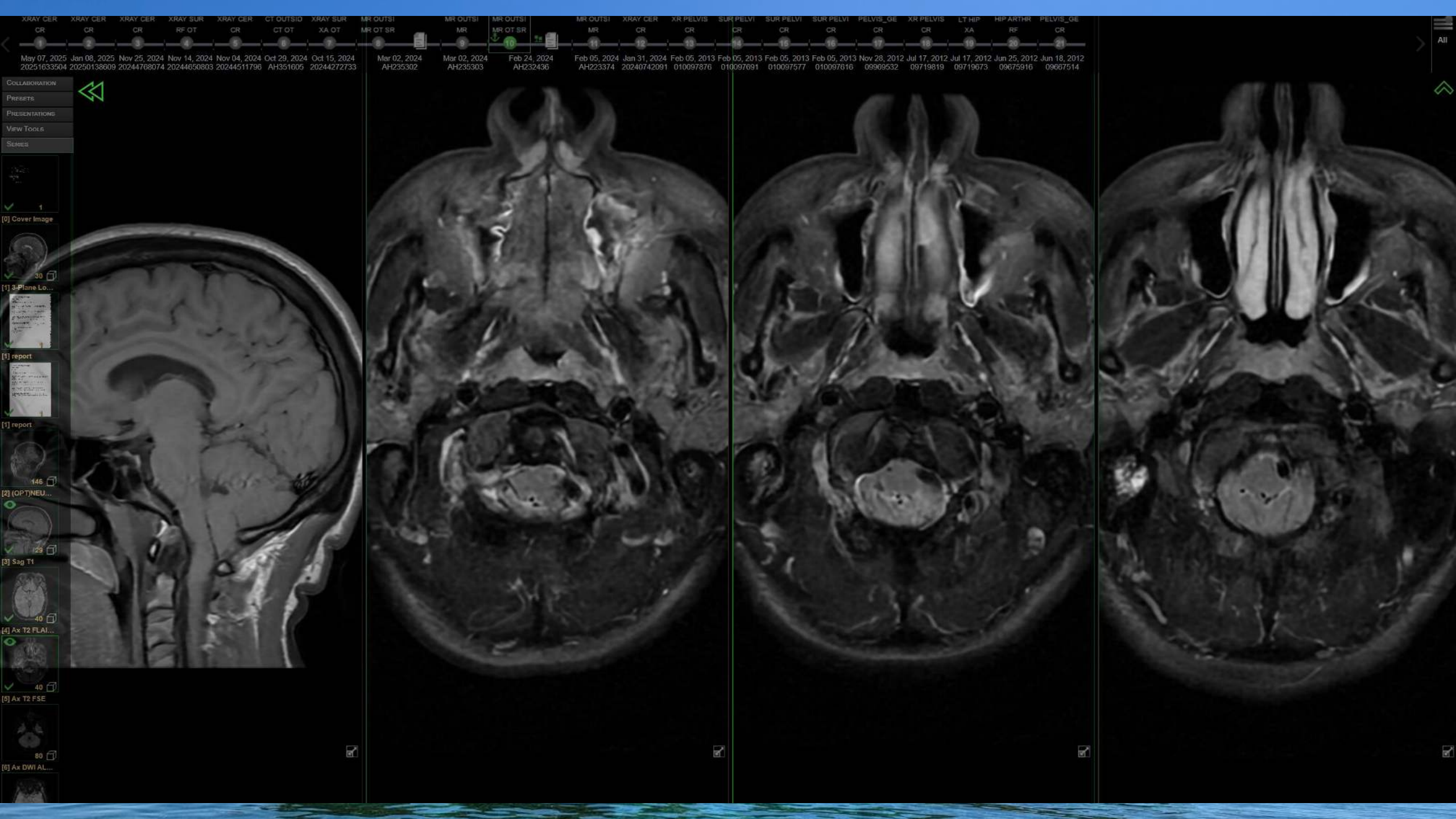


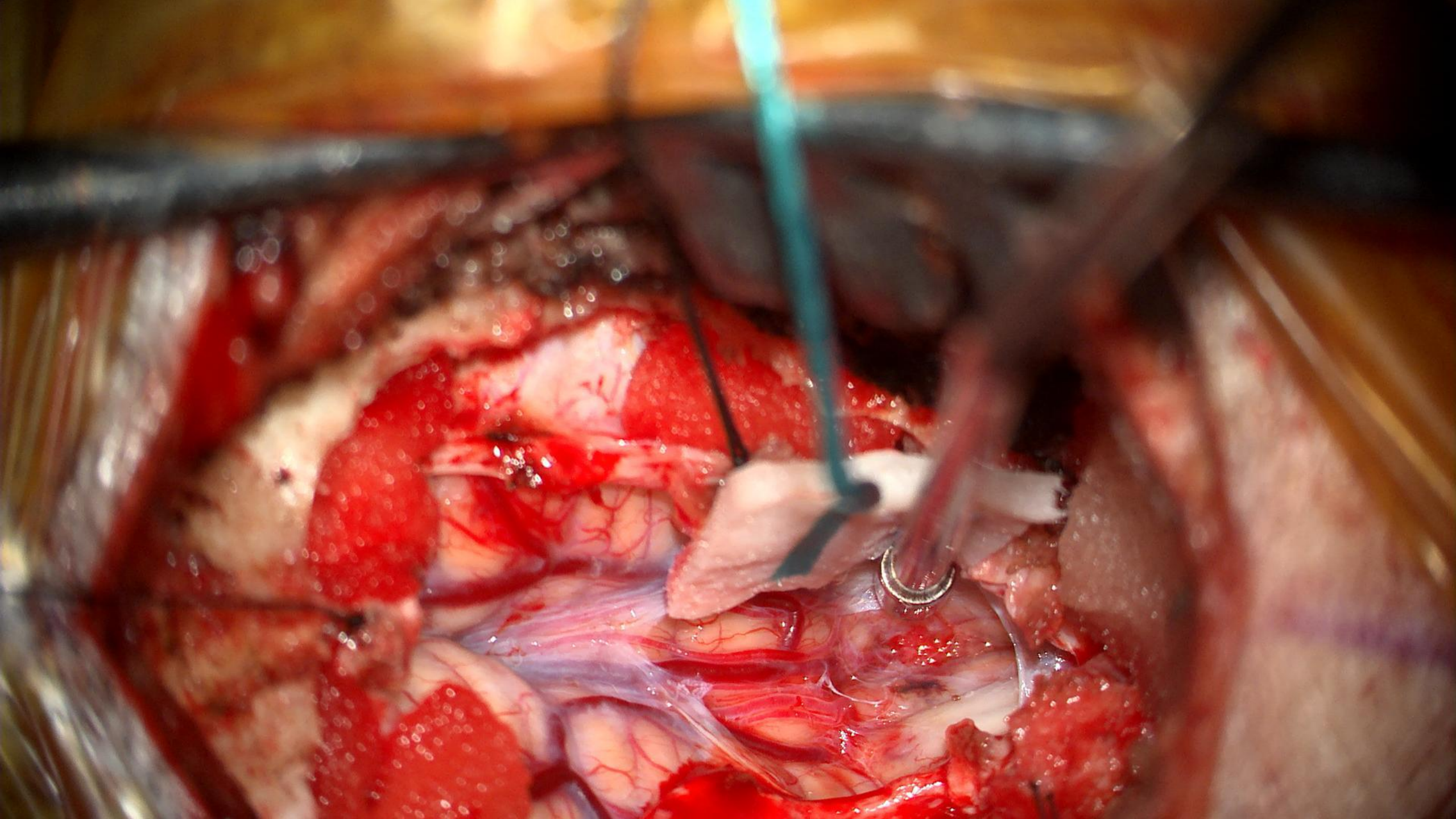
- Prior surgery – onlay dural graft

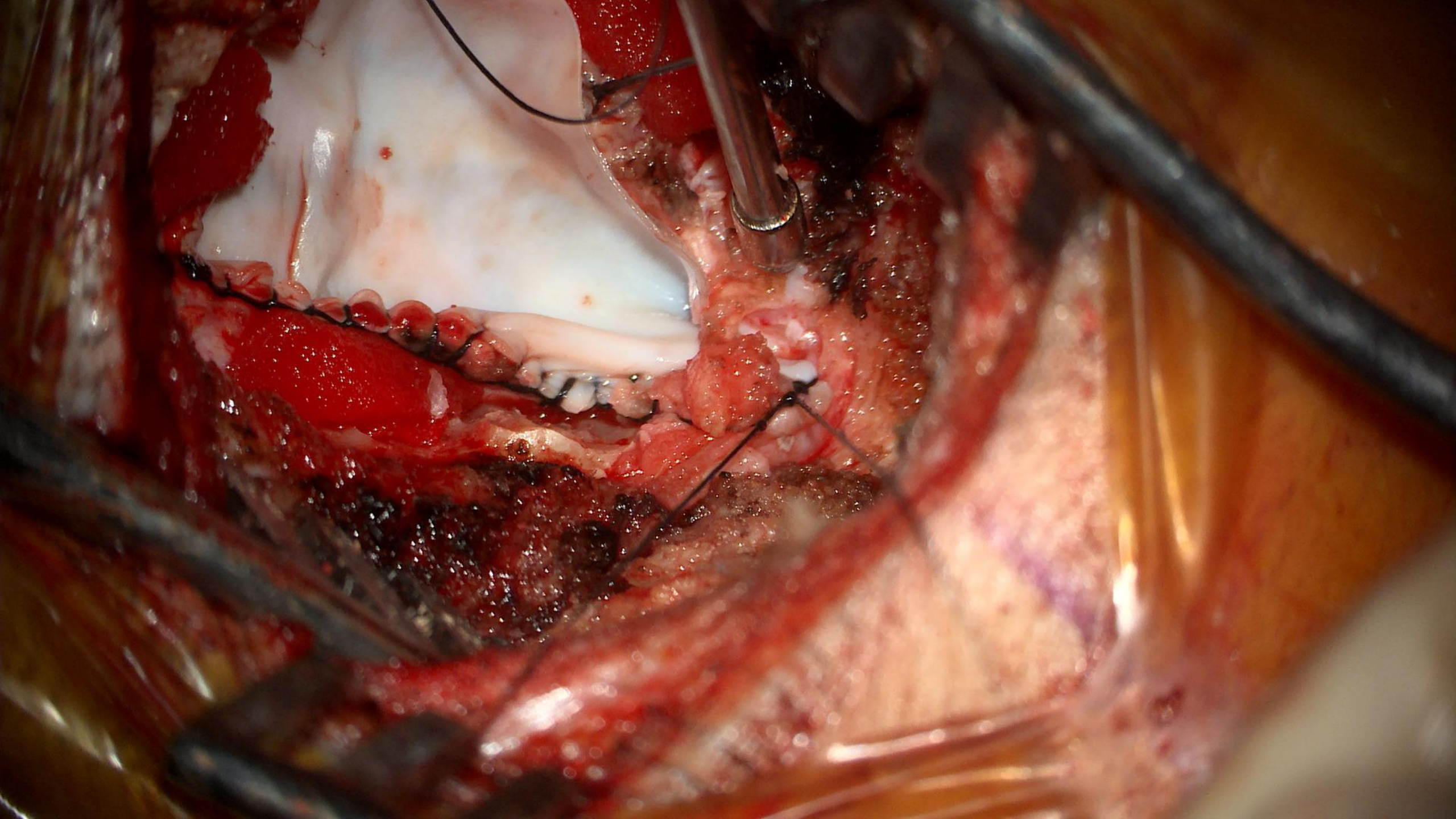
- Sutured Durepair. Anchored to bone in some areas
- DuraSeal
- Additional onlay graft
- Tisseel fibrin glue
- Acetazolamide x 1 month

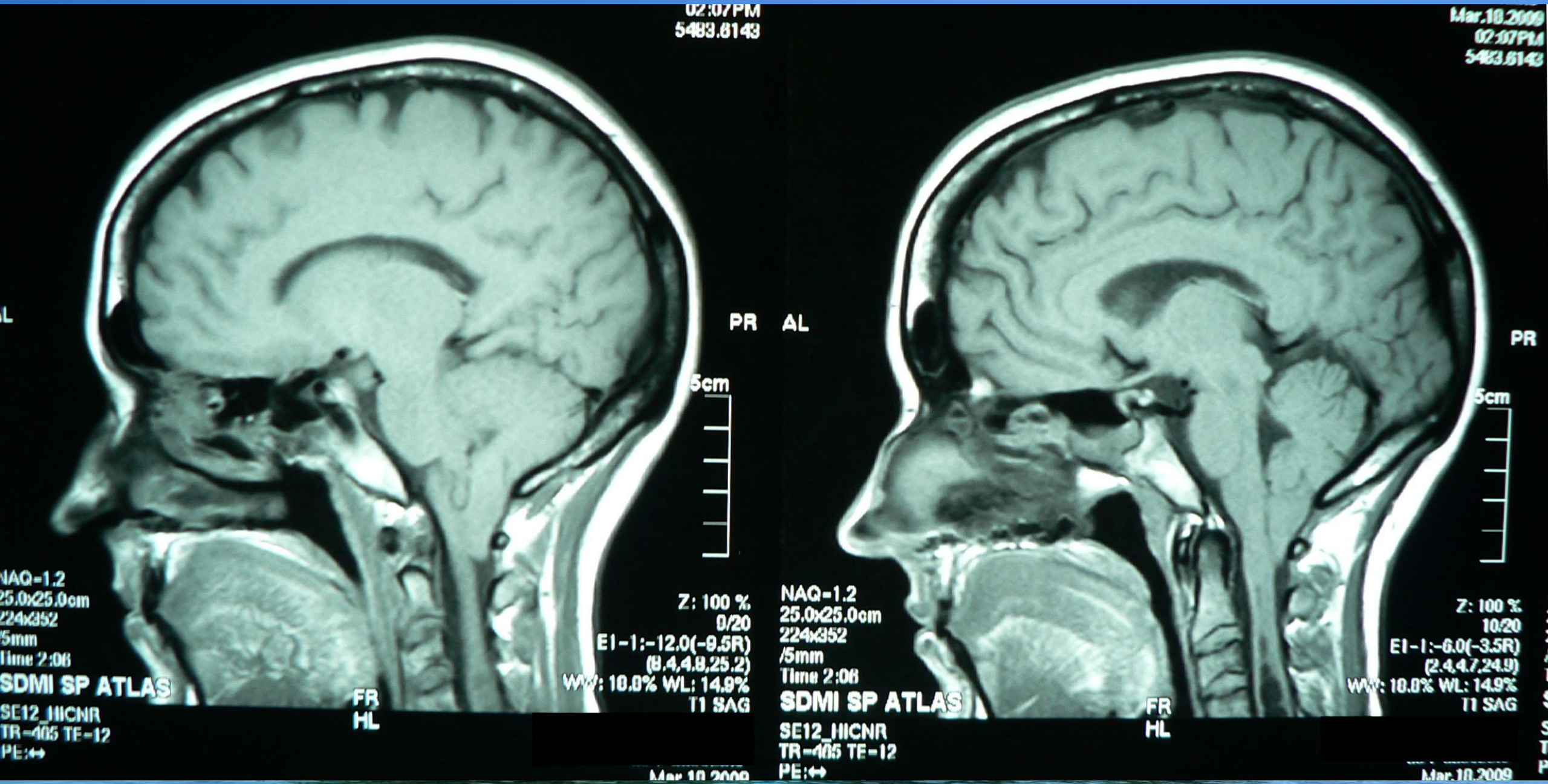

BRAIN^RT
MR
XR LUMBO
CR
SURABDO
CR
L-SPINE^M
MR
T-SPINE^M
MR PR
C-SPINE^M
MR PR
May 30, 2012
09629942
Oct 25, 2011
09225156
Oct 25, 2011
09224989
Oct 20, 2011
09213491
Oct 20, 2011
09213486
Oct 20, 2011
09213482
Collaboration
Presets
Presentations
View Tools
Series
R
portable
All

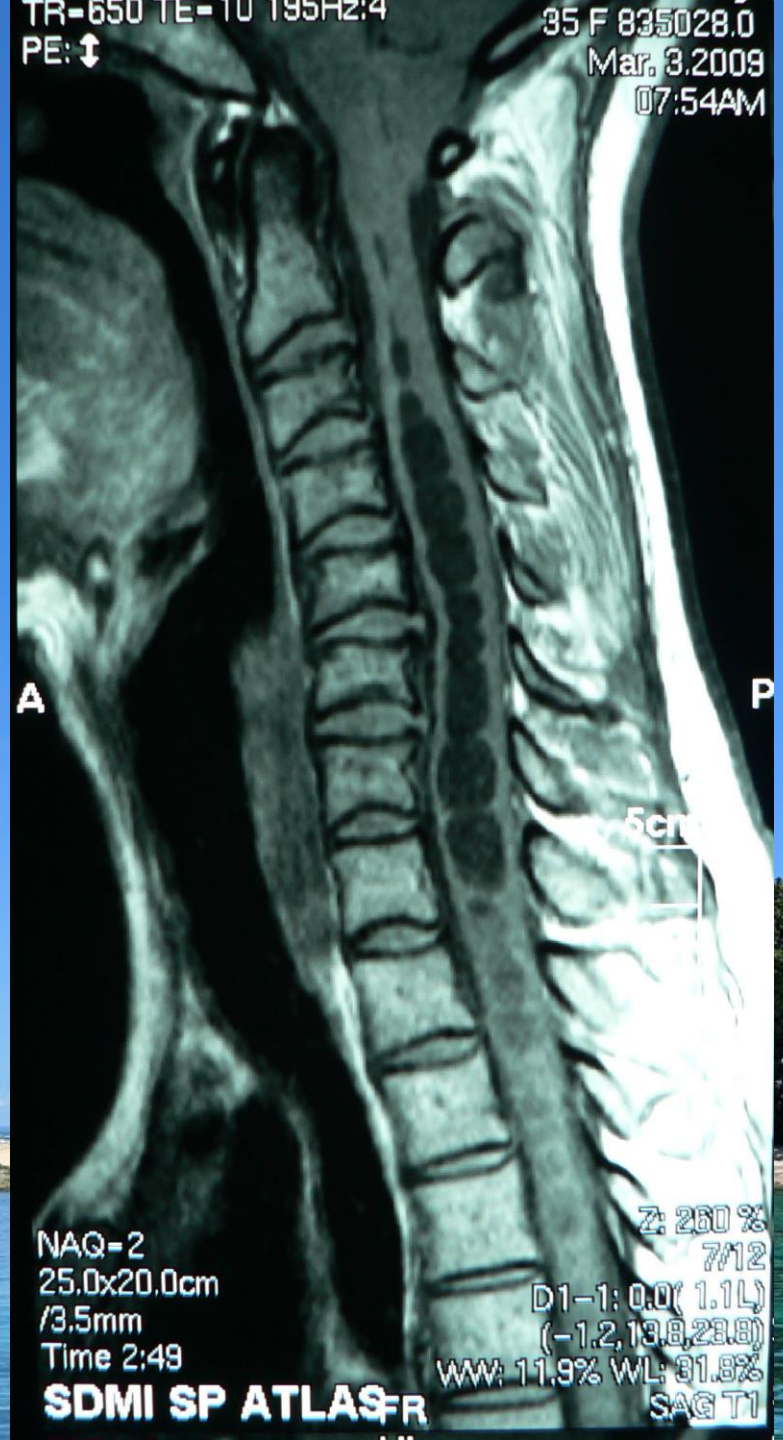
- 43 RH F w/ posterior and tussive HA x 3y
- Burning and tingling in both hands

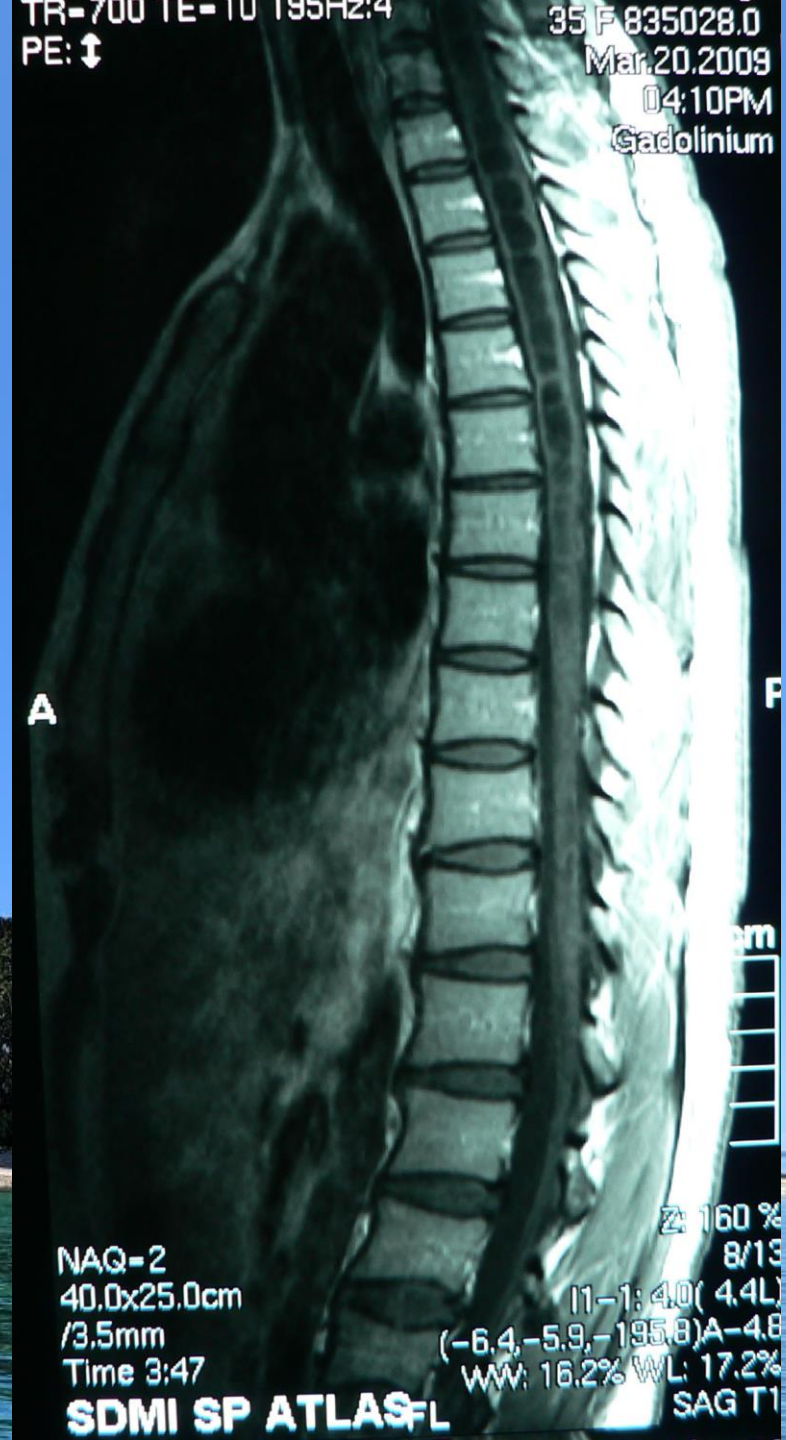

XRAY CER CR 1 May 07, 2025 20251633504
XRAY CER CR 2 Jan 08, 2025 20250138609
XRAY CER CR 3 Nov 25, 2024 20244768074
XRAY SUR RF OT 4 Nov 14, 2024 20244650803
XRAY CER CR 5 Nov 04, 2024 20244511796
CT OUTSID CT OT 6 Oct 29, 2024 AH351605
XRAY SUR XA OT 7 Oct 15, 2024 20244272733
MR OUTSI MR OT SR 8 Mar 02, 2024 AH235302
MR OUTSI MR 9 Mar 02, 2024 AH235303
MR OUTSI MR OT SR 10 Feb 24, 2024 AH232436
MR OUTSI MR 11 Feb 05, 2024 AH223374
XRAY CER CR 12 Jan 31, 2024 20240742091
XR PELVIS CR 13 Feb 05, 2013 010097876
SUR PELVI CR 14 Feb 05, 2013 010097691
SUR PELVI CR 15 Feb 05, 2013 010097577
SUR PELVI CR 16 Feb 05, 2013 010097616
PELVIS_GE CR 17 Nov 28, 2012 09969532
XR PELVIS CR 18 Jul 17, 2012 09719819
LT HIP XA 19 Jul 17, 2012 09719673
HIP ARTHR RF 20 Jun 25, 2012 09675916
PELVIS_GE CR 21 Jun 18, 2012 09667514
All
Collaboration
Presets
Presentations
View Tools
Series
[0] Cover Image
[1] 3-Plane Lo...
[1] report
[1] report
[2] (OPT)NEU...
[3] Sag T1
[4] Ax T2 FLAI...
[5] Ax T2 FSE
[6] Ax DWI AL...



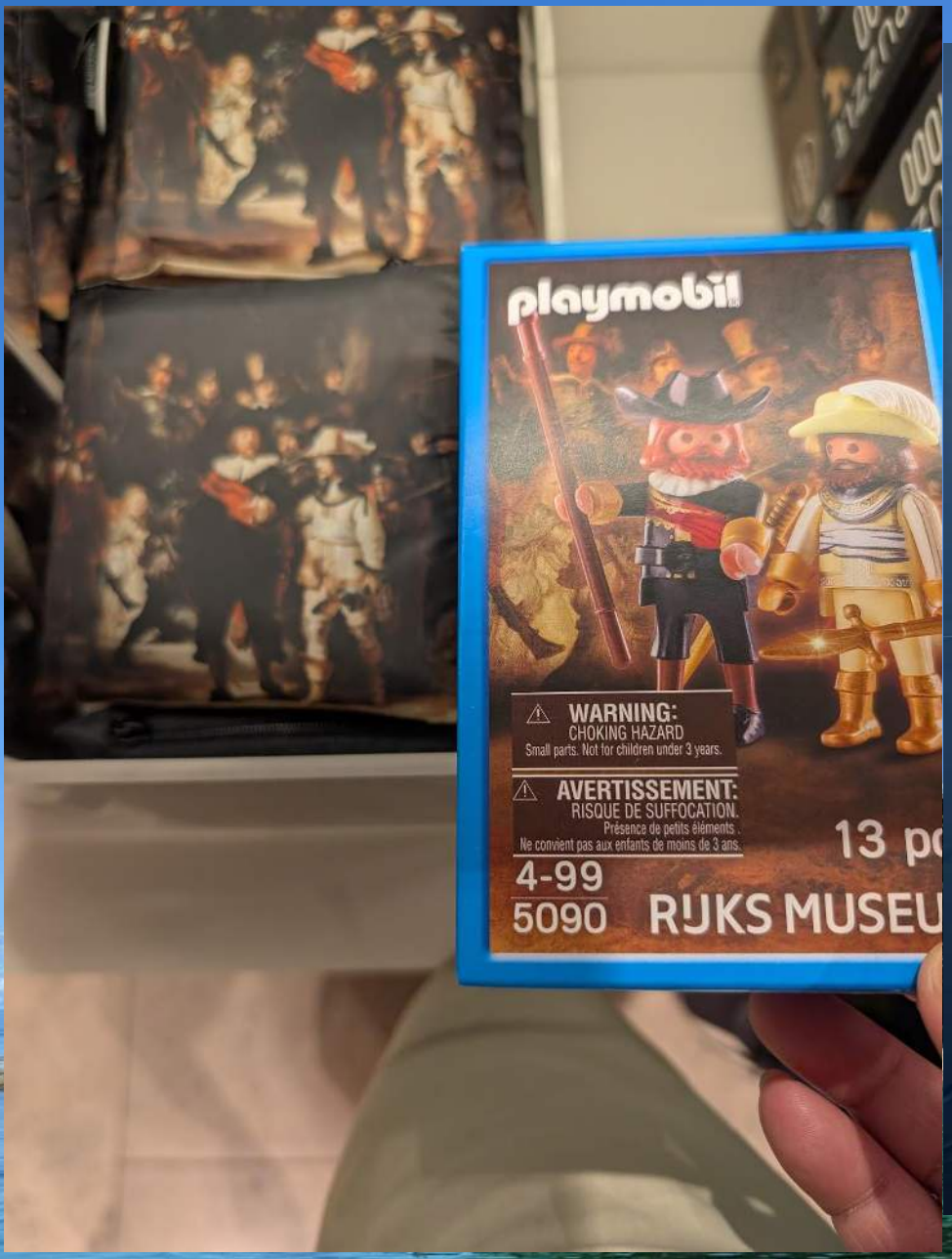



02:07PM
5483.8143
PR
AL
5cm
NAQ=1.2
25.0x25.0cm
224x352
/5mm
Time 2:06
SDMI SP ATLAS
SE12_HICNR
TR=405 TE=12
PE:↔
FR
HL
Z: 100 %
0/20
EI-1:-12.0(-9.5R)
(8.4,4.8,25.2)
WW: 10.0% WL: 14.9%
T1 SAG
Mar.10.2009
02:07PM
5483.8143
PR
5cm
NAQ=1.2
25.0x25.0cm
224x352
/5mm
Time 2:06
SDMI SP ATLAS
SE12_HICNR
TR=405 TE=12
PE:↔
FR
HL
Z: 100 %
10/20
EI-1:-6.0(-3.5R)
(2.4,4.7,24.9)
WW: 10.0% WL: 14.9%
T1 SAG
Mar.10.2009


TR-650 TE-10 195Hz:4
PE:
35 F 835028.0
Mar. 3.2009
07:54AM
A
P
5cm
Z: 260 %
7/12
NAQ-2
25.0x20.0cm
/3.5mm
Time 2:49
D1-1: 0.0(1.1L)
(-1.2,13.8,28.8)
WW: 11.9% WL: 31.8%
SAG T1
SDMI SP ATLAS
FR


TR-700 TE-10 195Hz:4
PE:
35 F 835028.0
Mar.20.2009
04:10PM
Gadolinium
A
P
Z: 160 %
8/13
NAQ-2
40.0x25.0cm
/3.5mm
Time 3:47
I1-1: 4.0(4.4L)
(-6.4,-5.9,-195.8)A-4.8
WW: 16.2% WL: 17.2%
SAG T1
SDMI SP ATLAS
FL

- Skull base CSF leaks are reparable
- Greater need for watertight closure, vascularized tissue auto-grafts, dural grafts, dural sealants
- Acetazolamide or lumbar drain placement
- Ventricular or lumbar shunt placement should be a last resort


playmobil
WARNING:
CHOKING HAZARD
Small parts. Not for children under 3 years.
AVERTISSEMENT:
RISQUE DE SUFFOCATION.
Présence de petits éléments.
Ne convient pas aux enfants de moins de 3 ans.
4-99
5090
RIJKS MUSEU


WELCOME
IN OUR SMALLEST MUSEUM

Ray Chu ray.chu@cshs.org 310-804-0918 m

Cedars Sinai
Department of Neurosurgery