Primary Brain Tumors

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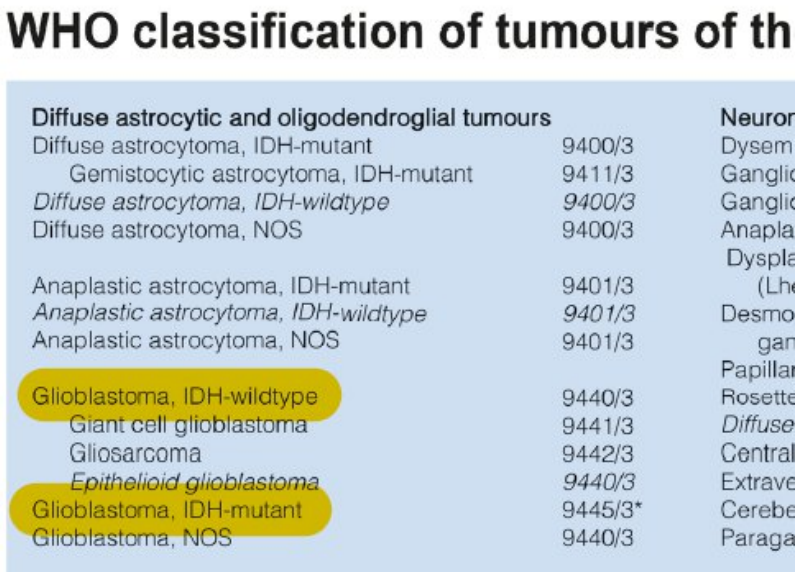
2007 WHO Classification

- Tumors of neuroepithelial tissue
- Tumors of cranial & paraspinal nerves
- Tumors of the meninges
- Lymphomas & hematopoietic neoplasms
- Germ cell tumors
- Tumors of the sellar region
- Metastatic tumors

The 2016 World Health Organization Classification of Tumors of the Central Nervous System

Abstract The 2016 World Health Organization Classification of Tumors of the Central Nervous System is both a conceptual and practical advance over its 2007 predecessor. For the first time, the WHO classification of CNS tumors uses molecular parameters in addition to histology to define many tumor entities, thus formulating a concept for how CNS tumor diagnoses should be structured in the molecular era.

The 2016 WHO Classification of Tumors of the CNS



WHO classification of tumours of th

Diffuse astrocytic and oligodendroglial tumours	
Diffuse astrocytoma, IDH-mutant	9400/3
Gemistocytic astrocytoma, IDH-mutant	9411/3
Diffuse astrocytoma, IDH-wildtype	*9400/3*
Diffuse astrocytoma, NOS	9400/3
Anaplastic astrocytoma, IDH-mutant	9401/3
Anaplastic astrocytoma, IDH-wildtype	*9401/3*
Anaplastic astrocytoma, NOS	9401/3
Glioblastoma, IDH-wildtype	9440/3
Giant cell glioblastoma	9441/3
Gliosarcoma	9442/3
Epithelioid glioblastoma	*9440/3*
Glioblastoma, IDH-mutant	9445/3*
Glioblastoma, NOS	9440/3

	IDH-wildtype glioblastoma	IDH-mutant glioblastoma	References
Synonym	Primary glioblastoma, IDH-wildtype	Secondary glioblastoma, IDH-mutant	{1830}
Precursor lesion	Not identifiable; develops de novo	Diffuse astrocytoma Anaplastic astrocytoma	{1827}
Proportion of glioblastomas	~90%	~10%	{1797}
Median age at diagnosis	~62 years	~44 years	{214,1078,1797, 2103}
Male-to-female ratio	1.42:1	1.05:1	{214,1417,1797}
Mean length of clinical history	4 months	15 months	{1797}
Median overall survival			
Surgery + radiotherapy	9.9 months	24 months	{1797}
Surgery + radiotherapy + chemotherapy	15 months	31 months	{2810}
Location	Supratentorial	Preferentially frontal	{1417}
Necrosis	Extensive	Limited	{1417}
TERT promoter mutations	72%	26%	{1801,1830}
TP53 mutations	27%	81%	{1797}
ATRX mutations	Exceptional	71%	{1519}
EGFR amplification	35%	Exceptional	{1797}
PTEN mutations	24%	Exceptional	{1797}

Presentation

- The most common presentation of brain tumors is progressive neurologic deficit (68%), usually motor (45%)

- Presentation differs acc. to the location of the tumor: supra or infratentorial.

Presentation
Supratentorial Tumors

- S/S of high ICP (from tumor, edema, HCP)
- Progressive neurodeficit (68%)
- Headache (54%)
- Seizures (26%)
- Mental status changes
- TIA like symptoms
- Endocrine disturbances like in pituitary tumors

Presentation
Infratentorial Tumors

- S/S of High ICP (2ry to HCP): Headache, vomiting, ….

- S/S of mass effect:
  - Cerebellum: Ataxia
  - Brainstem: cranial nerve involvement, long tract abnormalities, nystagmus

Presentation of Brain Tumors

- Signs & symptoms might be:
  - Nonfocal: Headache, vomiting, ….
  - Focal neurologic deficit: related to the area of damaged brain

Clinical presentation
Signs & Symptoms

Generalized	Focal
Headaches	Seizures
Seizures	Weakness
Nausea/vomiting	Sensory loss
Depressed level of consciousness	Aphasia
Neurocognitive dysfunction	Visual spatial dysfunction

Focal neurologic deficit

Lobe	Deficit
Frontal	Personality Changes, hemiparesis, dysphasia
Temporal	Auditory & olfactory hallucinations
Parietal	Contralateral sensory loss
Occipital	Contralateral visual field deficits
Post. fossa	Ataxia, cranial nerve deficits

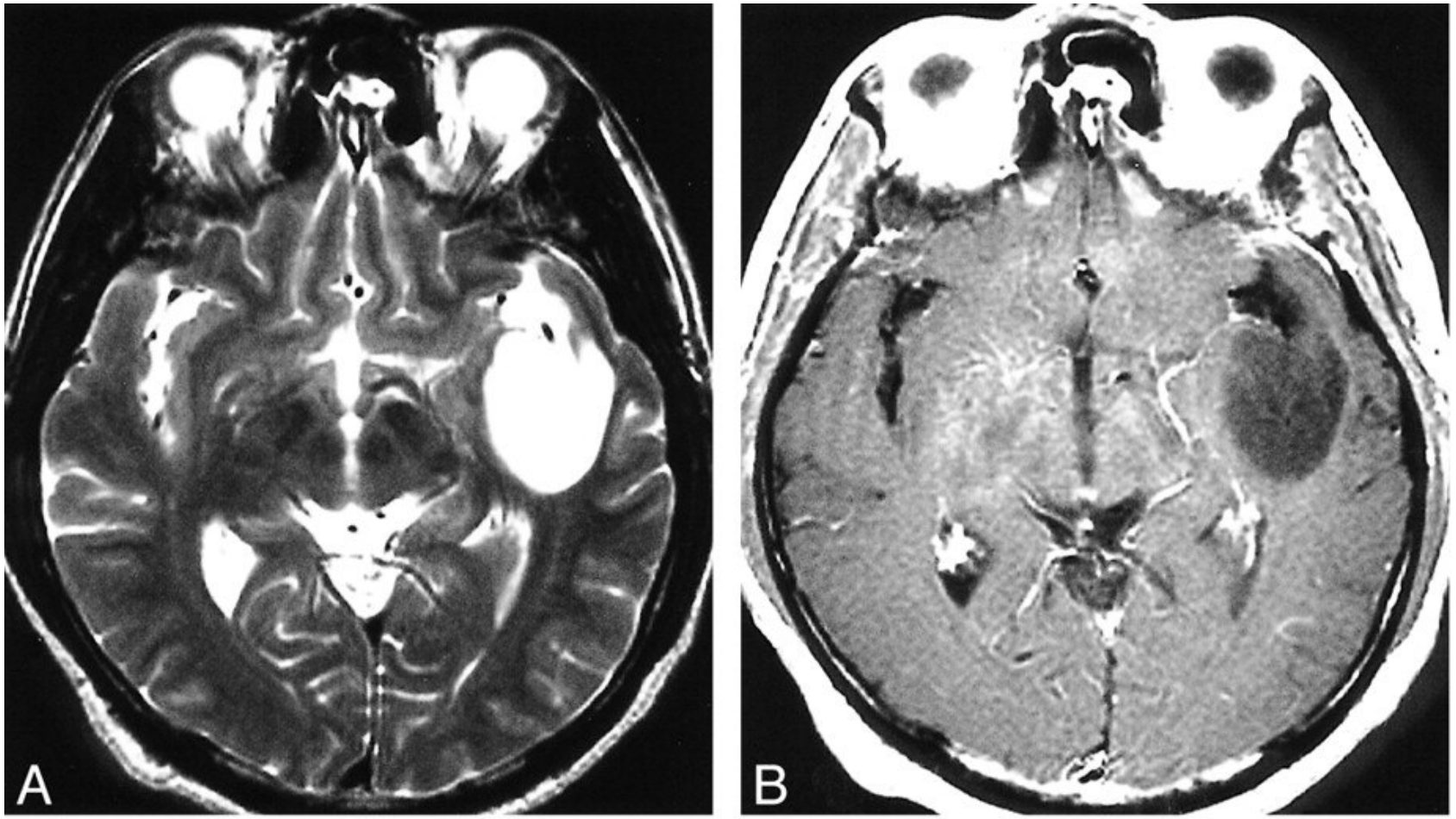
Glioma

- Gliomas account for over 80 % of primary CNS malignancies. The term "glioma" refers to tumors believed to be derived from glial cells (i.e., astrocytes, oligodendrocytes, and ependymal cells).
- Gliomas are grossly devided to low grade & high grade (more malignant) ones.

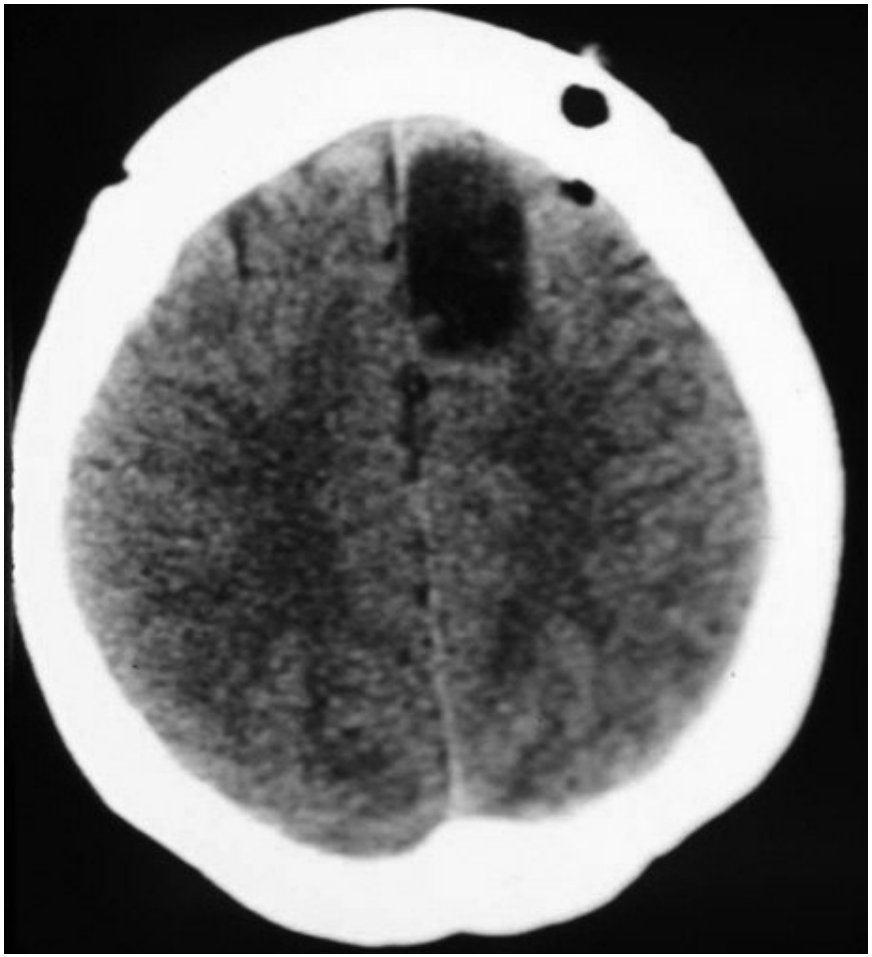
Low Grade Gliomas

- Occur in young adults or children
- Often diagnosed after a H/O seizures
- MRI: ↓on T1, ↑on T2. 30% enhance
- For definitive diagnosis, biopsy needed
- Treatment: Complete excision is often sufficient. If it is not possible, then adjuvant therapy is required

Low Grade Gliomas - MRI



Low Grade Gliomas - CT



High Grade Gliomas

- ≈50% of primary brain tumors
- Older patient
- Short duration of symptoms
- Median survival is much shorter
- CT & MRI: most enhance & show necrosis & significant mass effect. Usually involve more than one lobe & might cross to the other side.
- Treatment: Cytoreductive surgery, radio- & chemotherapy

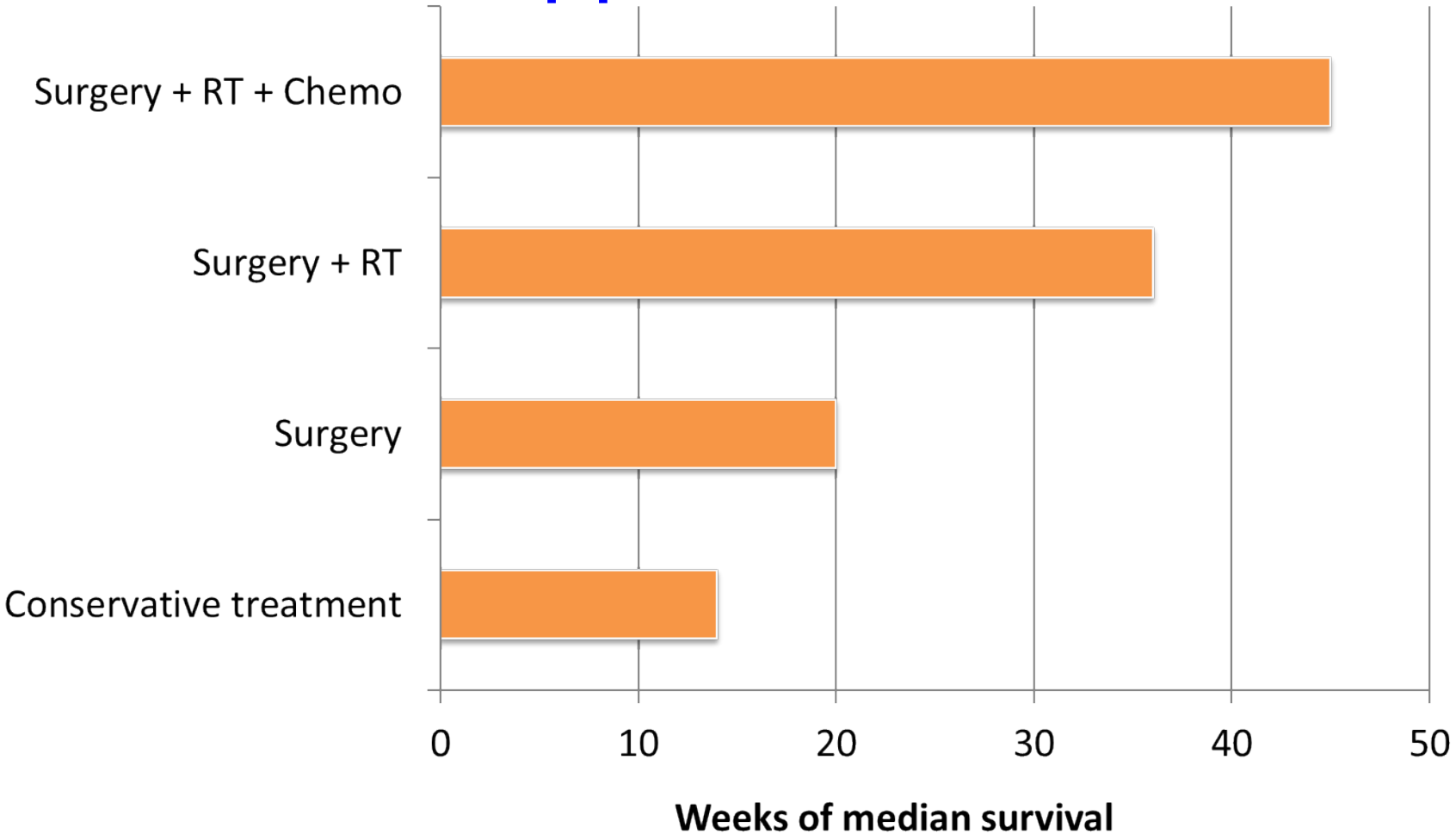
Adjuvant RT in HGG

- Improves local control
- Improves survival after resection (14 $\rightarrow$ 36 wks)
- Superior to Chemotherapy as adjuvant postop.
- Adequate dose 50-60 Gy
- Involved field RT (IFRT) has replaced WBRT as the standard approach.
- Newer approaches (e.g., focal conformal RT, intensity modulated RT) are being developed.

Adjuvant Chemotherapy in HGG

- Can further improve survival after surgery & adjuvant RT.
- Nitrosoureas [Carmustine(BCNU), PCV]
- Temozolomide: (the current standard agent for adjuvant chemotherapy, used in GBM, more limited data support its use in the elderly and in patients with AA)

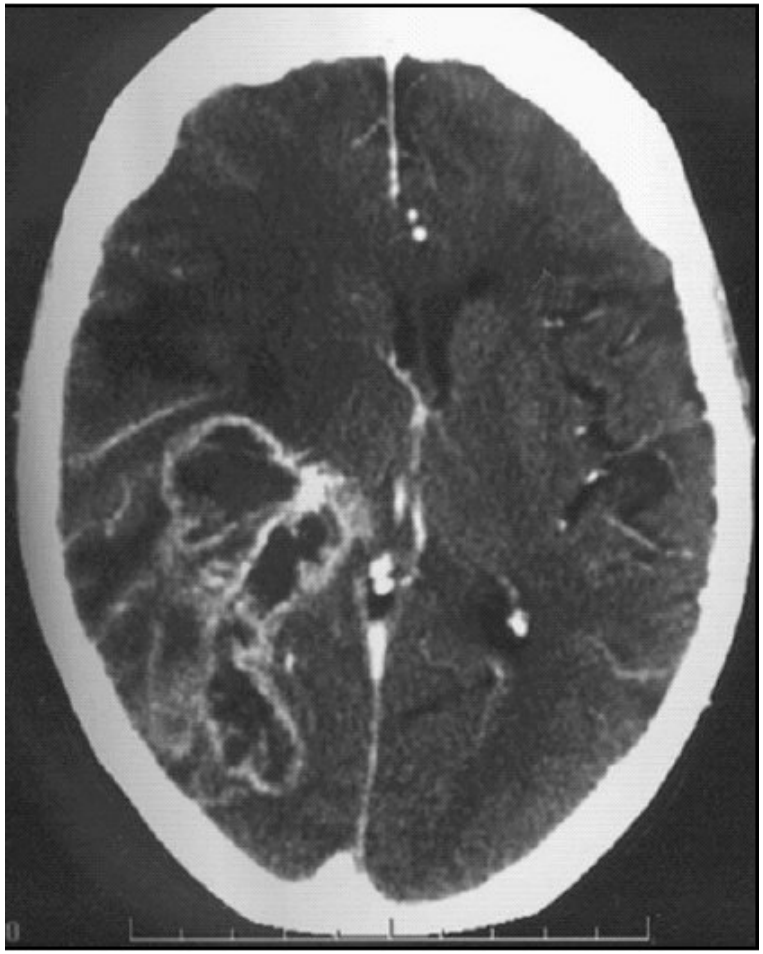
Management of malignant glioma: Survival with multimodal approaches



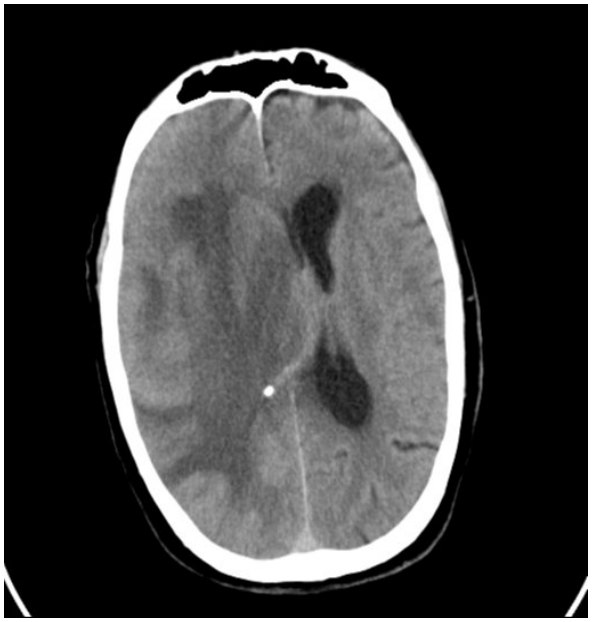
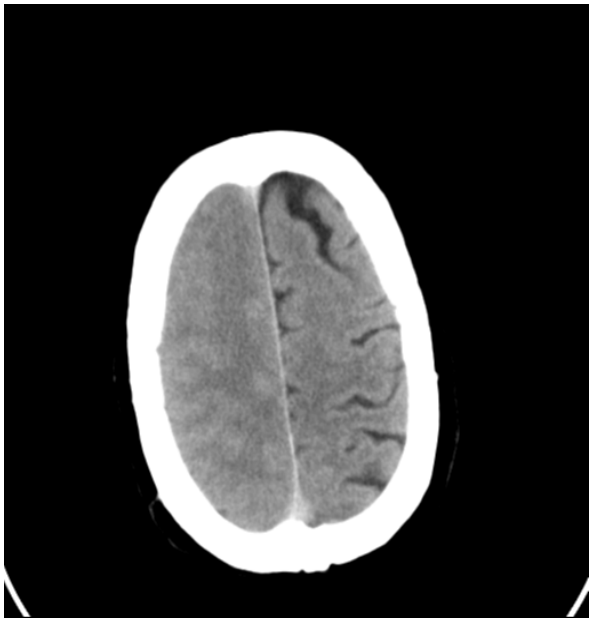
High Grade Gliomas - MRI



High Grade Gliomas - CT



HGG

WHO Grading in Astrocytoma

1	More circumscribed tumors (like Pilocytic astrocytoma)
2	Diffuse astrocytoma (Cytological atypia alone)
3	Anaplastic astrocytoma (Mitosis)
4	Glioblastoma (microvascular proliferation & or necrosis). It is unfortunately the most common primary brain tumor ≈40%

Grade & Survival in Astrocytomas

- Median Survival for Astrocytomas

Grade	Median Survival
1	8-10 yrs
2	7-8 yrs
3	2-3 yrs
4	1 yr >

Meningioma

- Slow gorwing, extraaxial tumor, usually benign
- Common locations: falx, convexity, sphenoid b
- CT: isodense, intense homogenous enhancement, broad based dural attachment, hyperostosis of adjacent bone
- MRI: isointense on T1, ↓ on T2. Same enhancement pattern as CT.

Meningioma

- Surgical indications: Growing ones & Symptomatic ones.

- Can be cured if totally removed, but total removal not always possible.

Meningioma - MRI

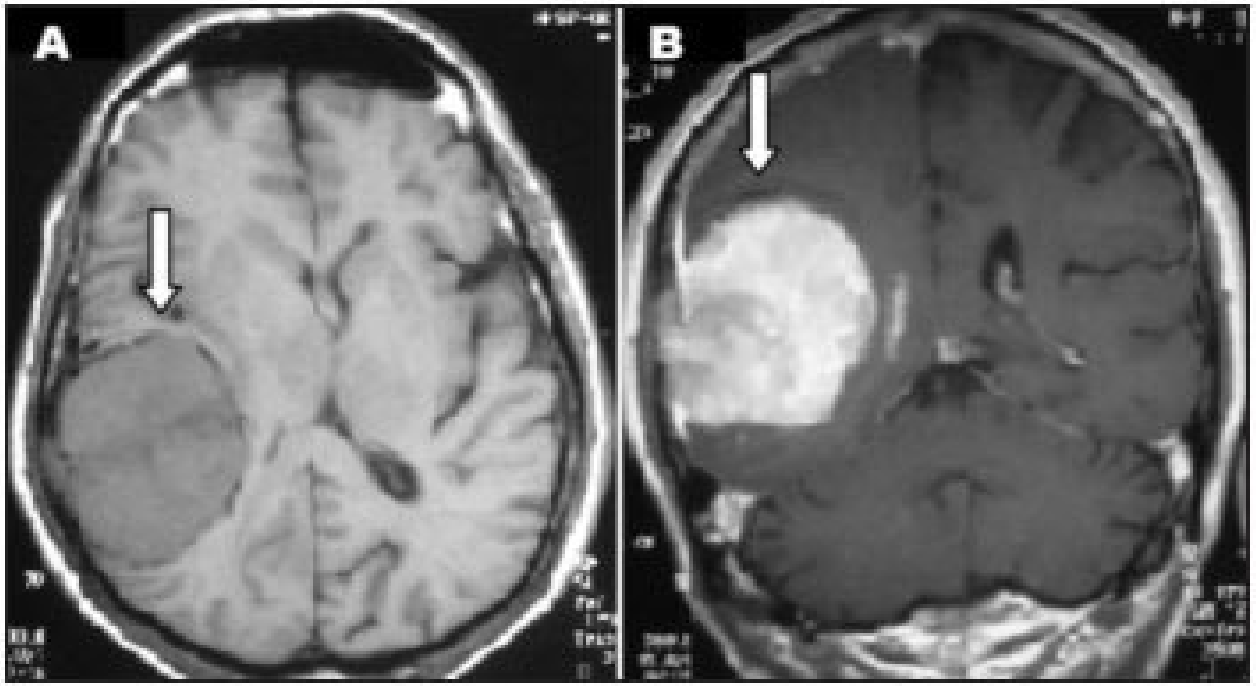
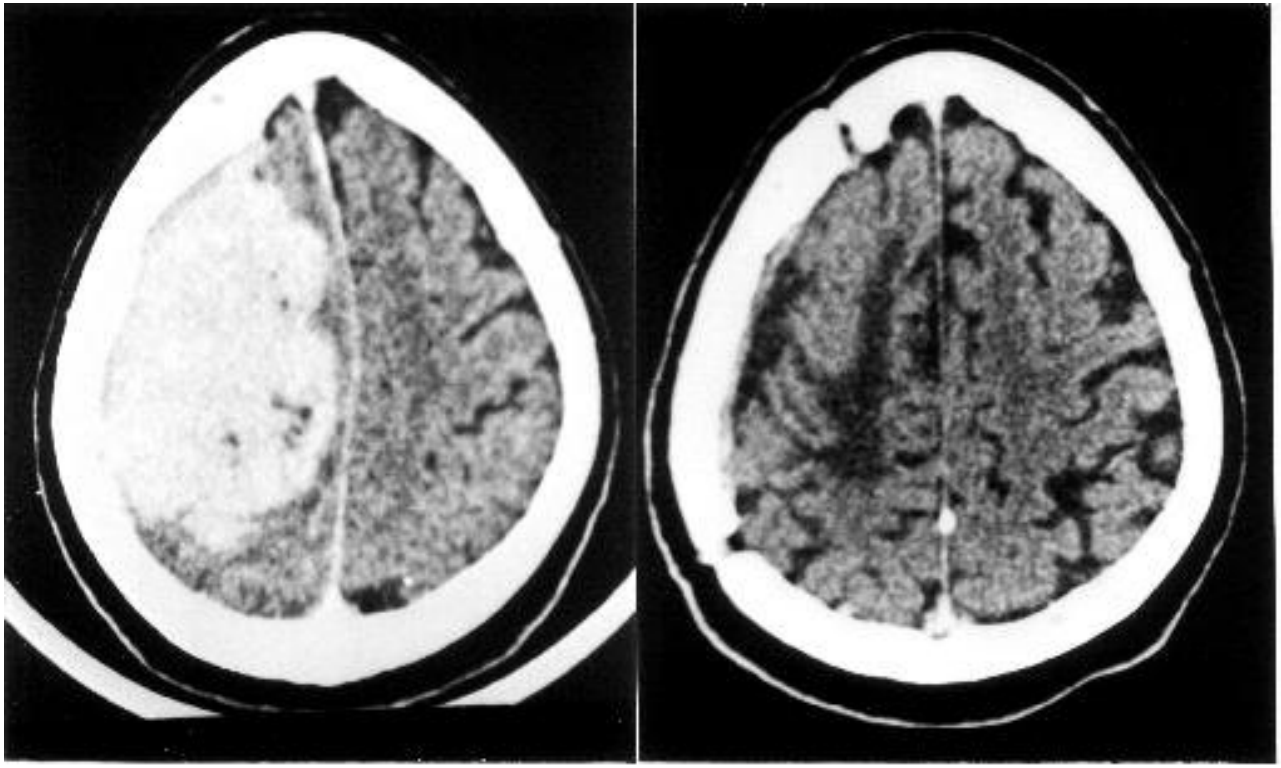


Fig 1. [A] Axial T1-weighted MRI of the brain showing a homogenous hypointense lesion with defined limits in the right temporoparietal lobe. [B] Coronal T1-weighted section after gadolinium administration showing intense and homogenous contrast enhancement.

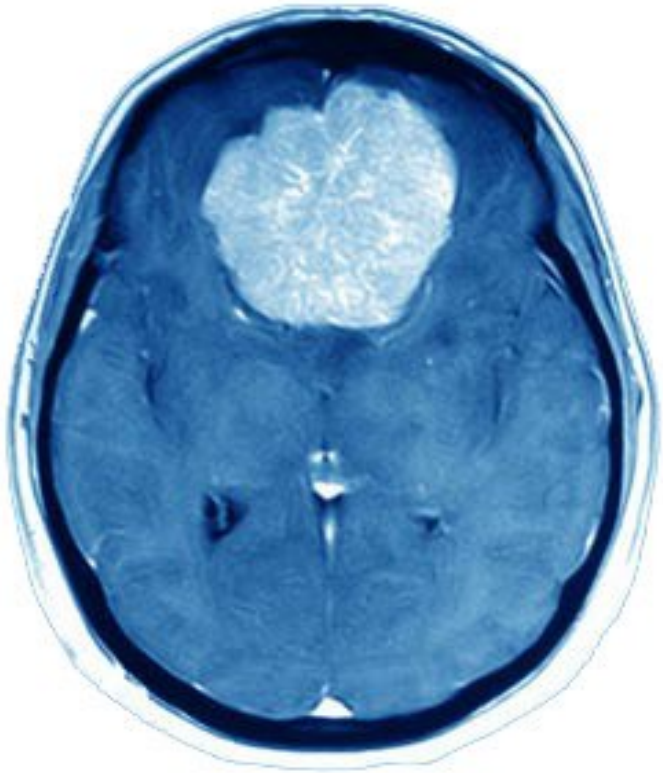
Meningioma – CT (with contrast)



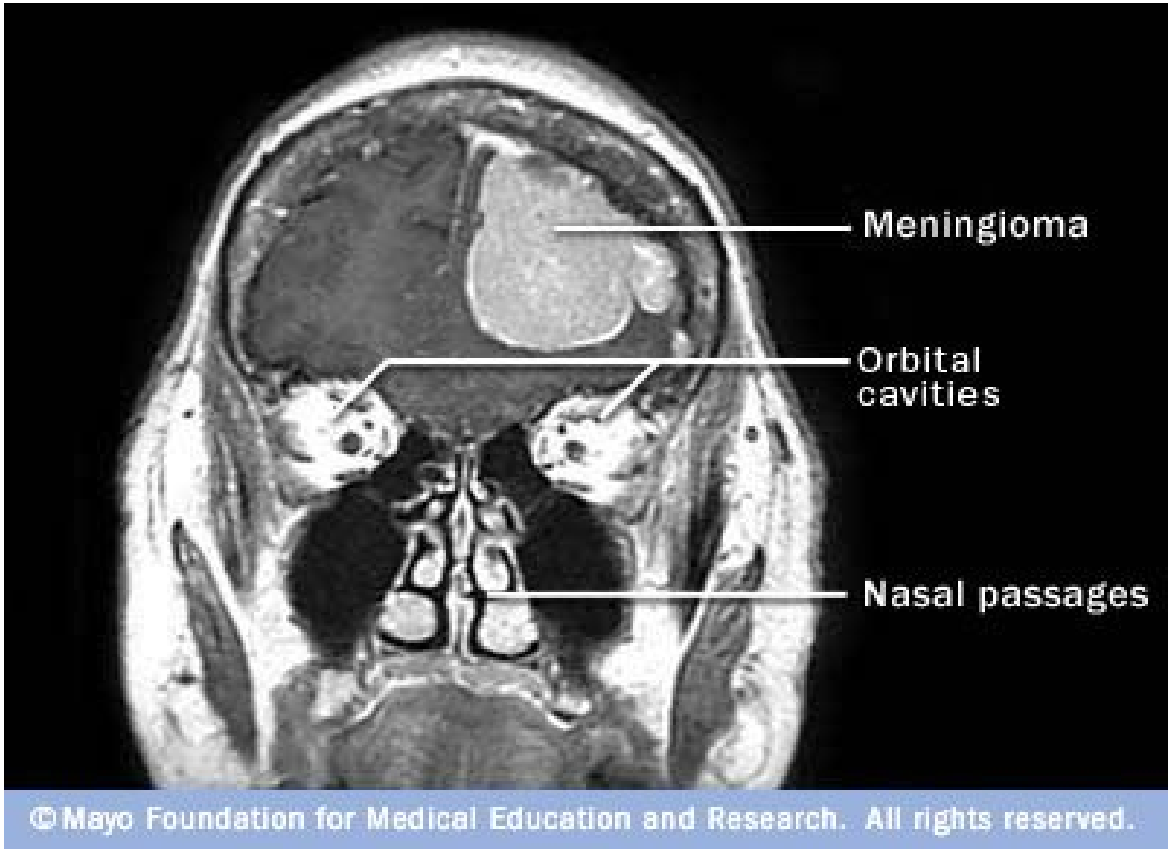
Meningioma – CT (pre & postop)



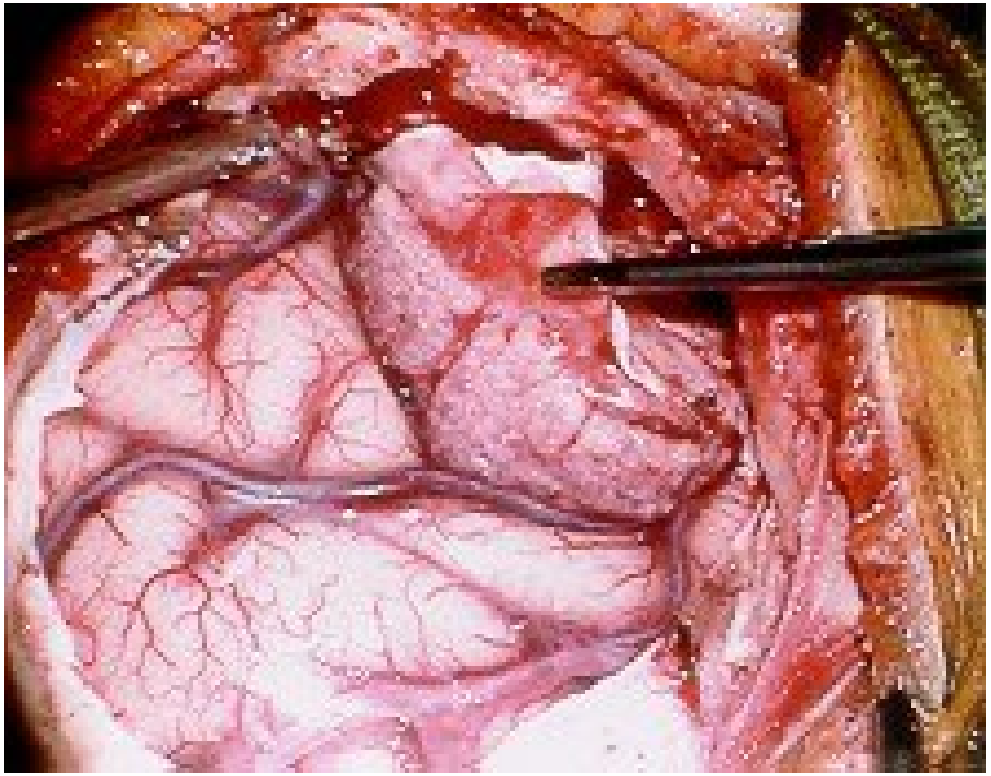
Meningioma – Olfactory groove



Meningioma - Convexity



Convexity Meningioma Surgery



Steroid use in brain tumors

- Adult: 10 mg (Dexamethasone) IV loading then 6 mg Q6 hrs
- Pediatrics: 0.5 mg/kg IV loading, then 0.25 mg/kg/d divided Q6 hrs.
- Avoid prolonged use & if that needed maintain on the smallest effective dose
- Protect the stomach
- Pts already on steroids: Double the dose

Anticonvulsants in brain tumors

- No routine use of prophylactic AED
- For pts undergoing craniotomy, proph. AED may be used & if there is no seizure, AED can be stopped one week postop
- AEDs are indicated in pts presenting with seizure (30% of brain tumors) or developing seizure later (another 30%)

CT in brain tumors

- CT has largely been replaced by cranial MRI
- Used in emergency situations (unstable Pt)
- Used in intartumoral Hge
- Used when MRI is C/I or unavailable

Postop CT

Should be done without & with IV contrast enhancement either in the 1st 2 days postop or after 30 days post op.

Karnofsky Performance Scale (KPS)

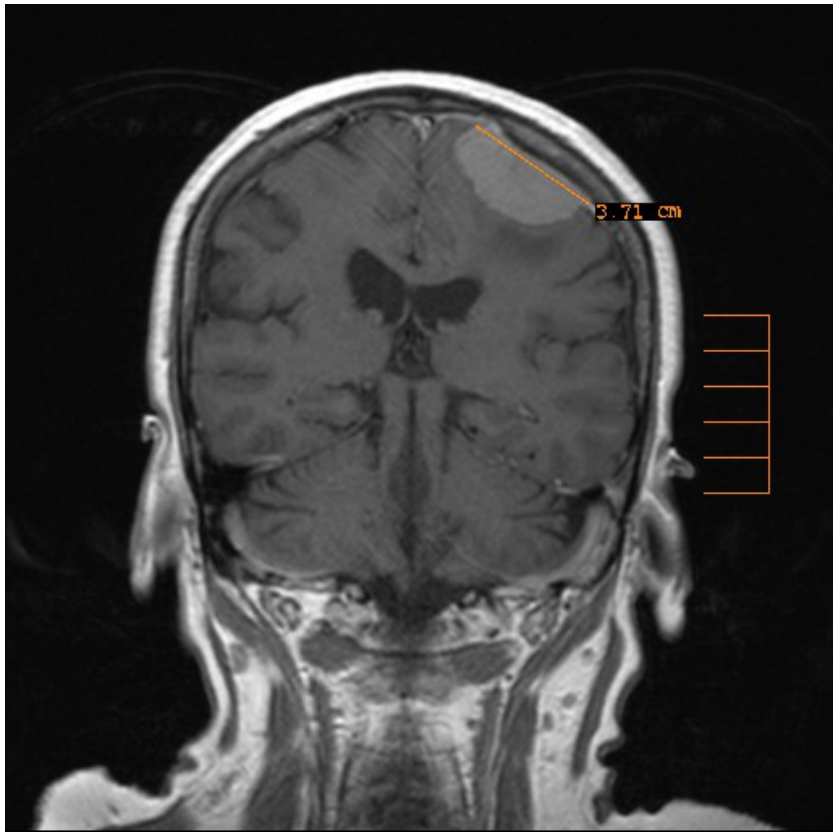
Rating	Definition
100 percent	No evidence of disease
90 percent	Normal activity with minor signs of disease
80 percent	Normal activity with effort; signs of disease
70 percent	Cannot do normal activity but cares for self
60 percent	Requires occasional assistance
50 percent	Requires considerable assistance; frequent medical care
40 percent	Disabled, requires special care
30 percent	Severely disabled; hospitalization may be indicated
20 percent	Very sick; hospitalization necessary for supportive treatment
10 percent	Moribund
0 percent	Death

Some of our cases at EGH

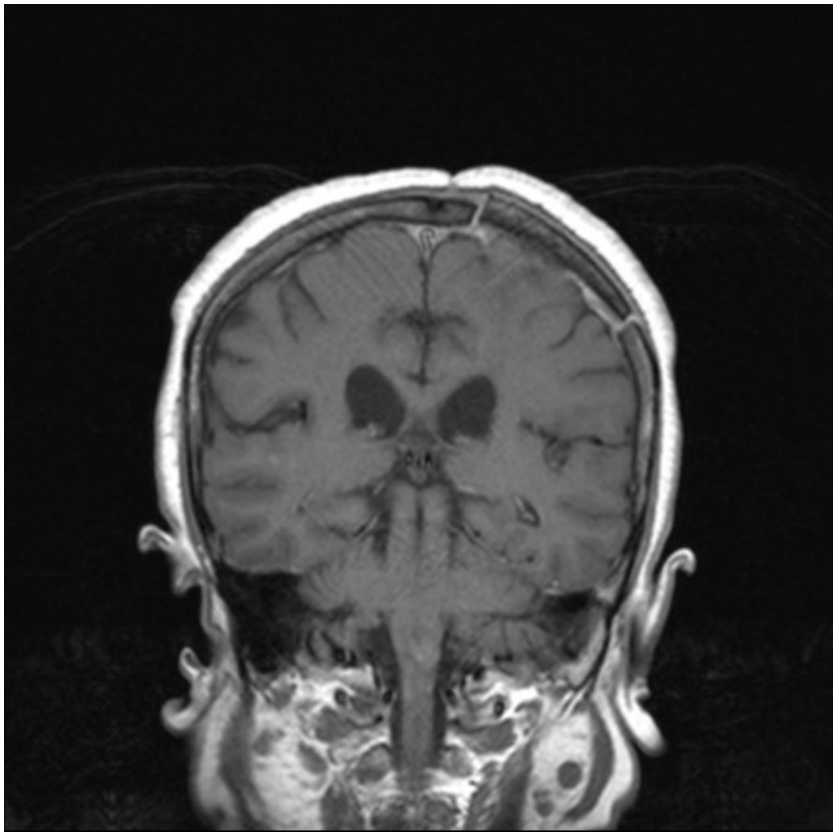
Case 1

65yrs, F, Lt posterior frontal Meningioma Gr2, Sz (Jan 12)

Preop

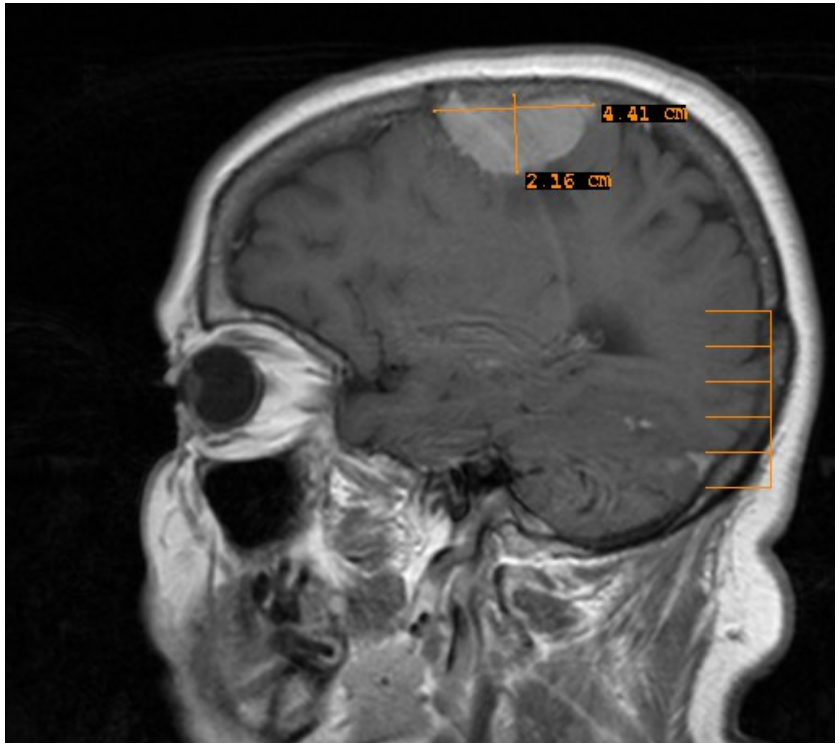


Postop

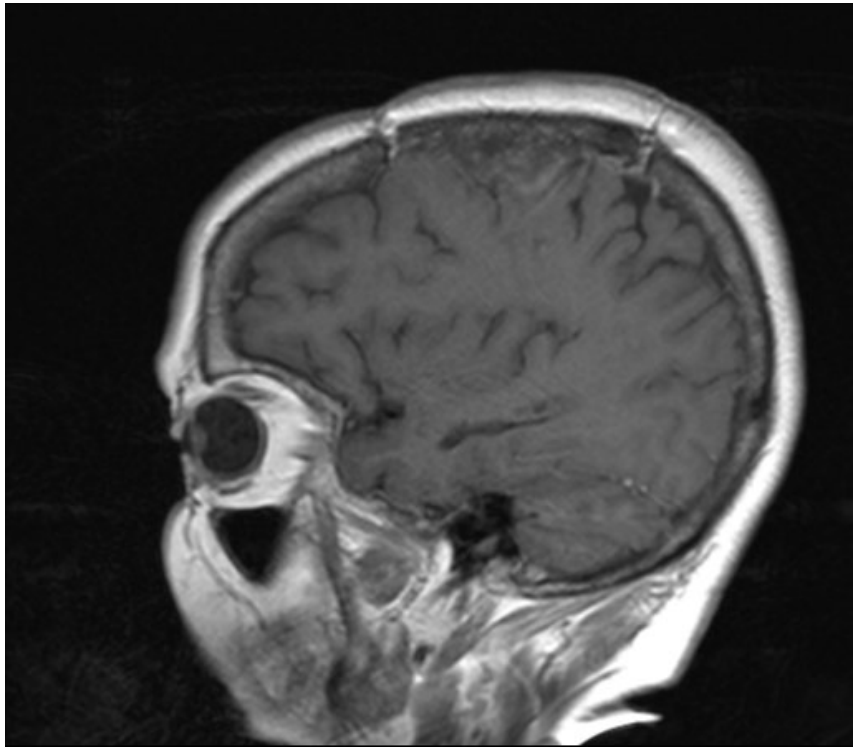


Case 1

Preop



Postop



Case 1

4th day postop





Case 1

Recurrence in June 2014

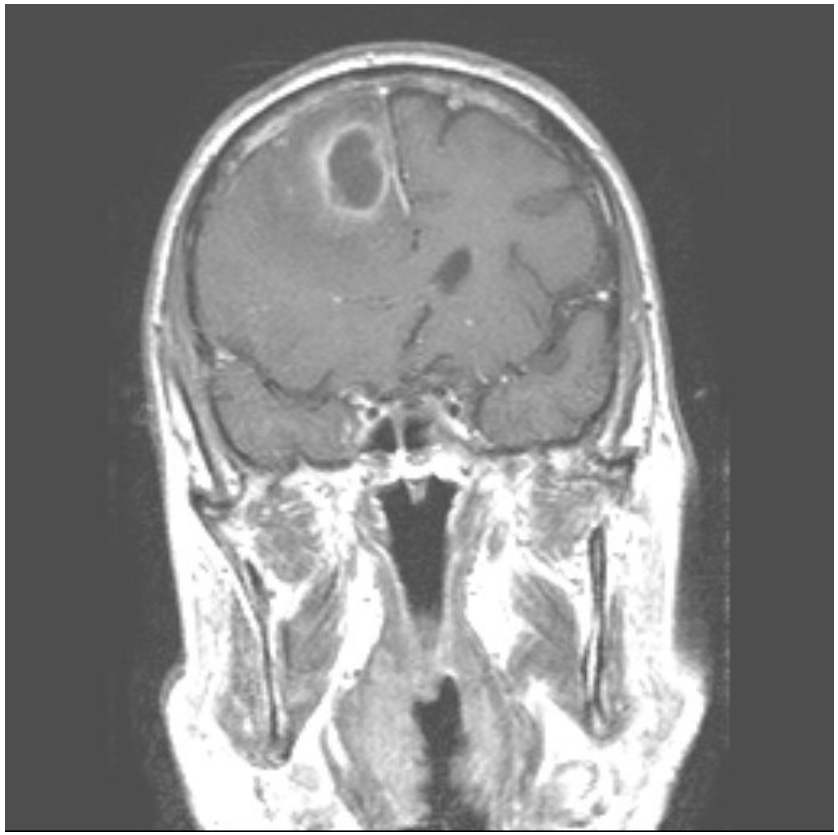




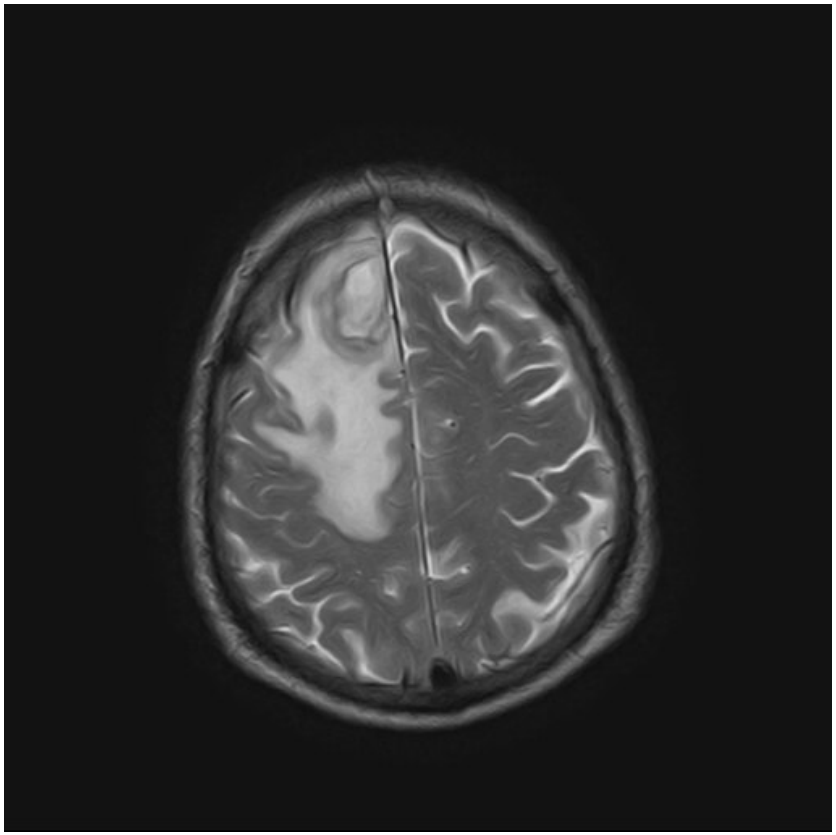
Case 2

60yrs, M, Rt frontal HGG Gr3, Coma, Lt hemi (Aug 12)

Preop with contrast



Preop T2



Case 2

Post op

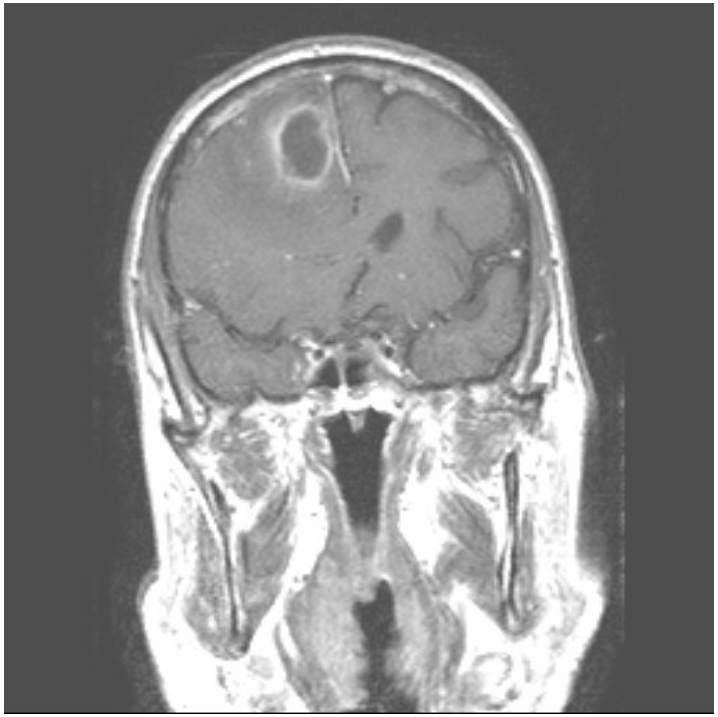




Case 2

Post op

Preop



Dec 2014



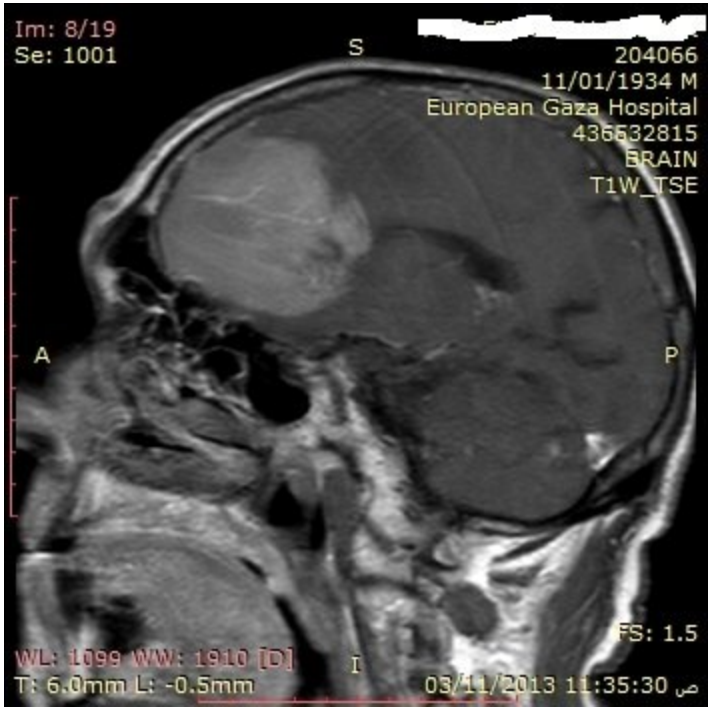
Case 3

79yrs, M, Lt frontal Meningioma, Behaviour ch.
(Nov 13)

Preop cor. with contrast

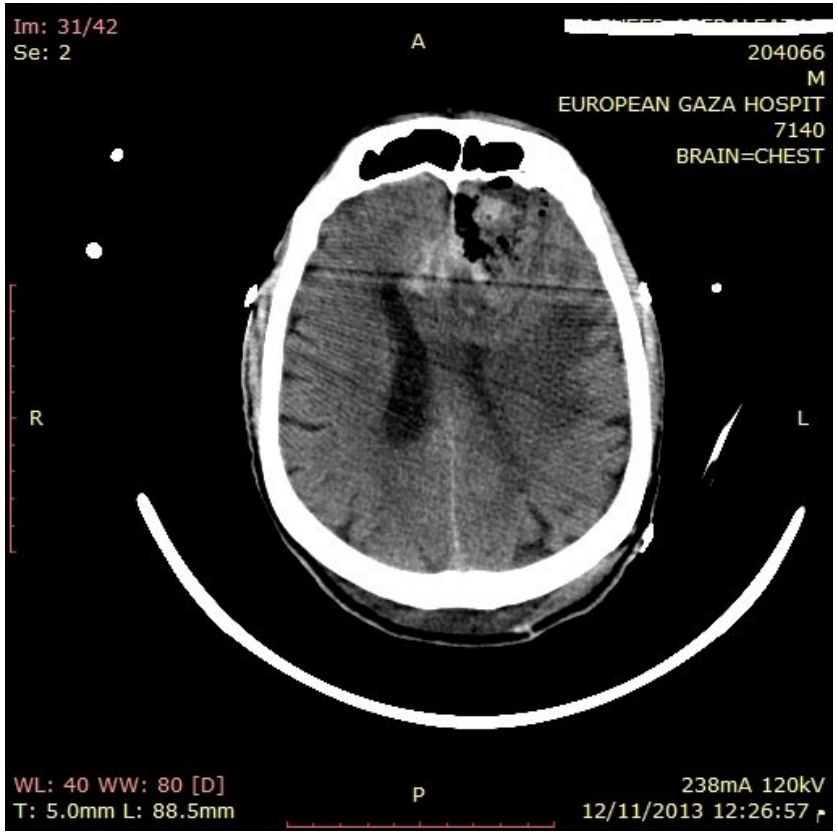


Preop sag. with contrast



Case 3

Postop CT



Post-ICU Chest CT

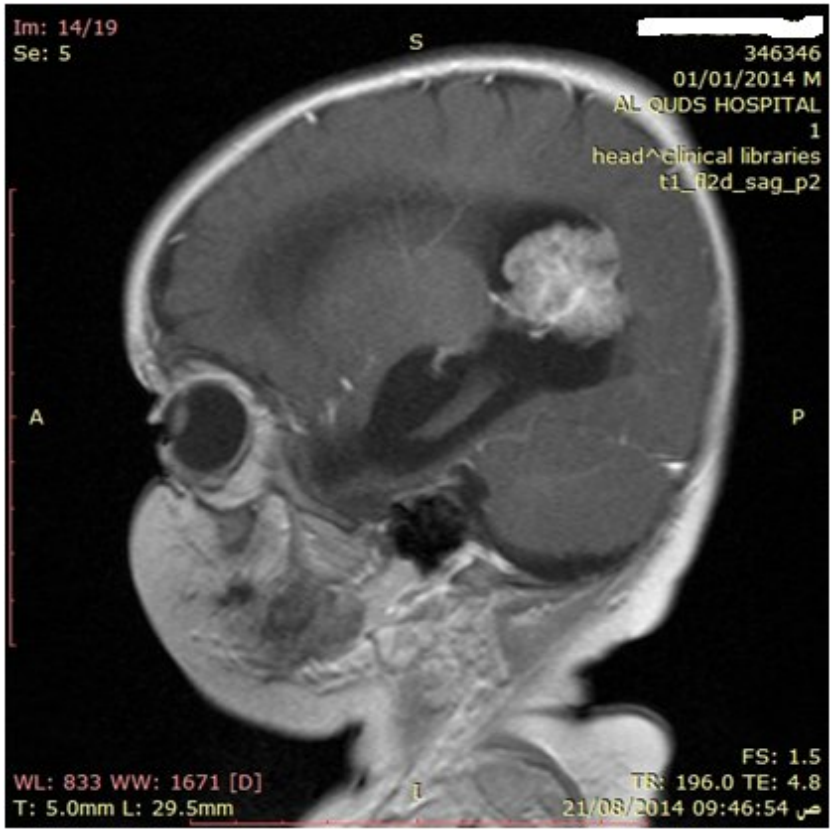


Case 4

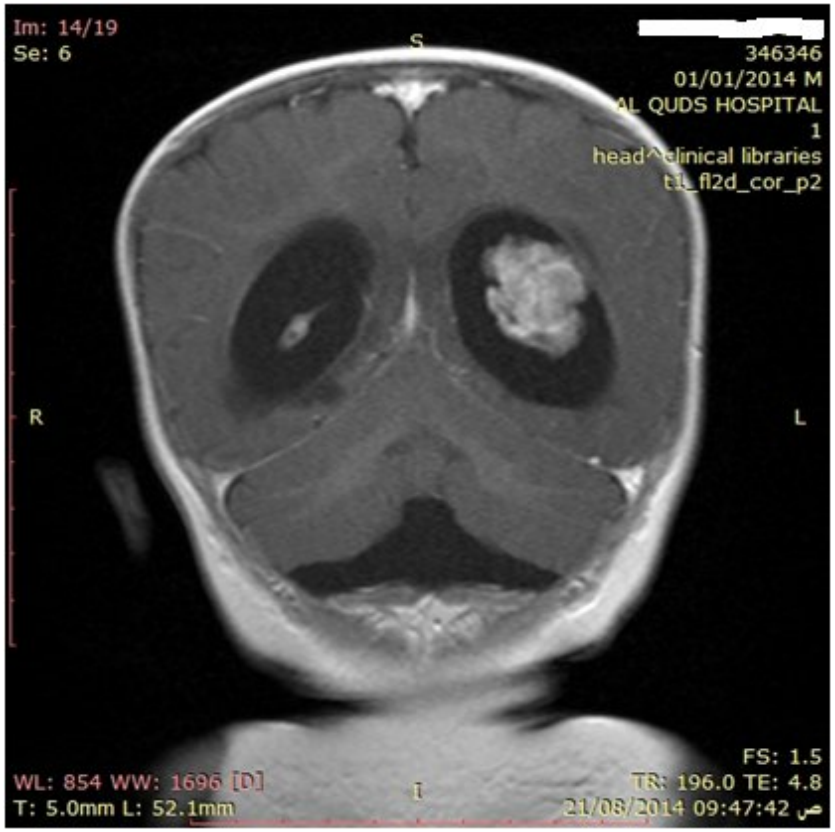
Spot diagnosis?

6mths M (Aug 14)

Sagital with contrast

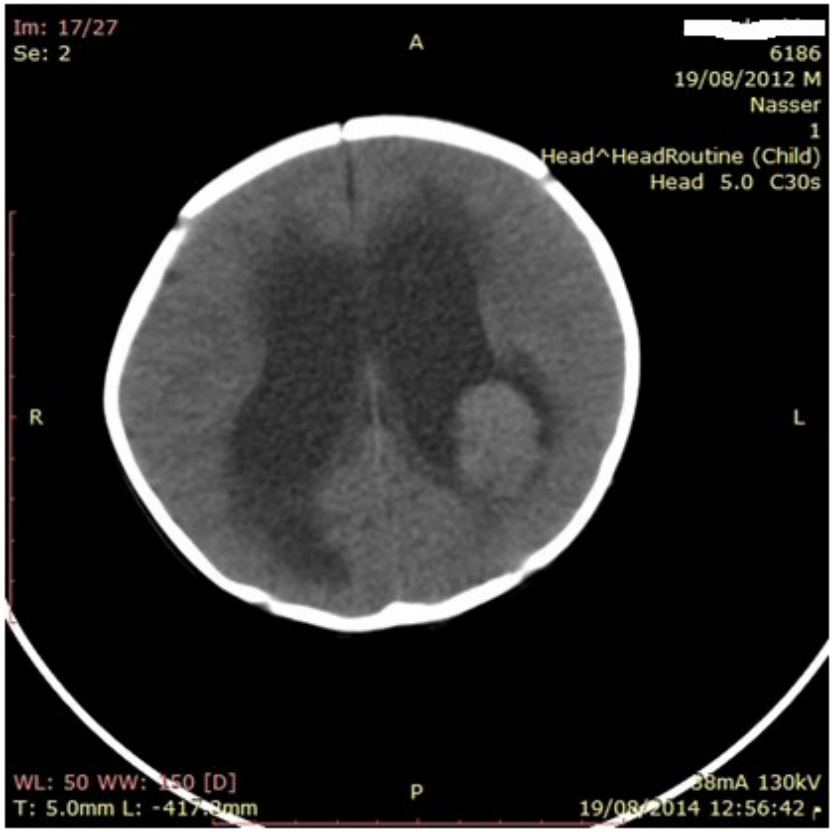


Coronal with contrast

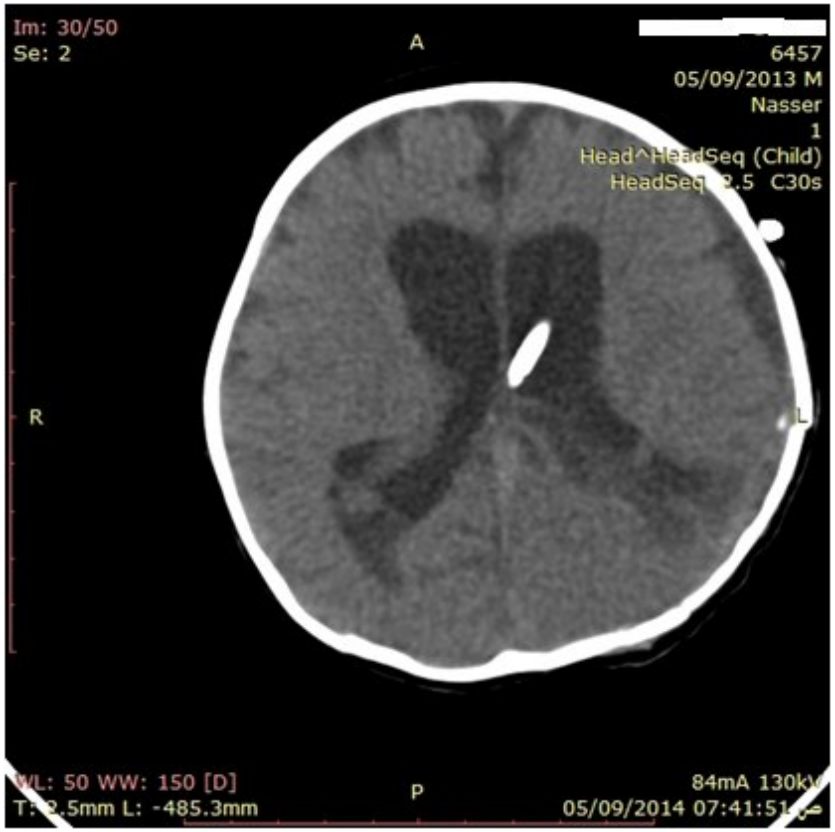


Case 4

Preop CT



Postop CT



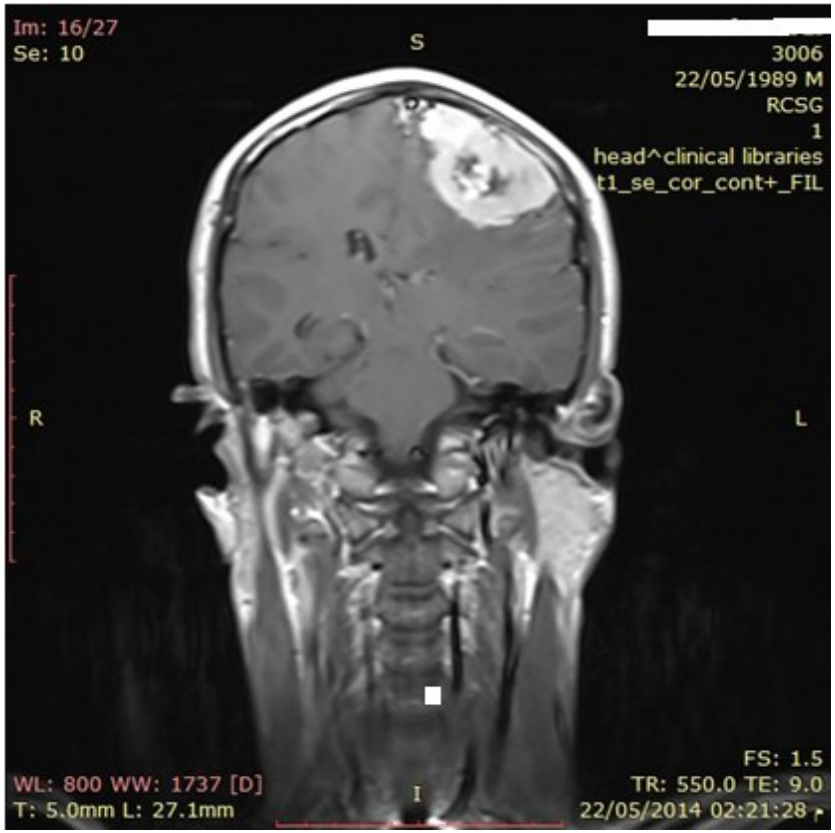
Case 5

Lt frontoparietal Meningioma Gr2
25yrs, M, (June 14)

Axial with contrast

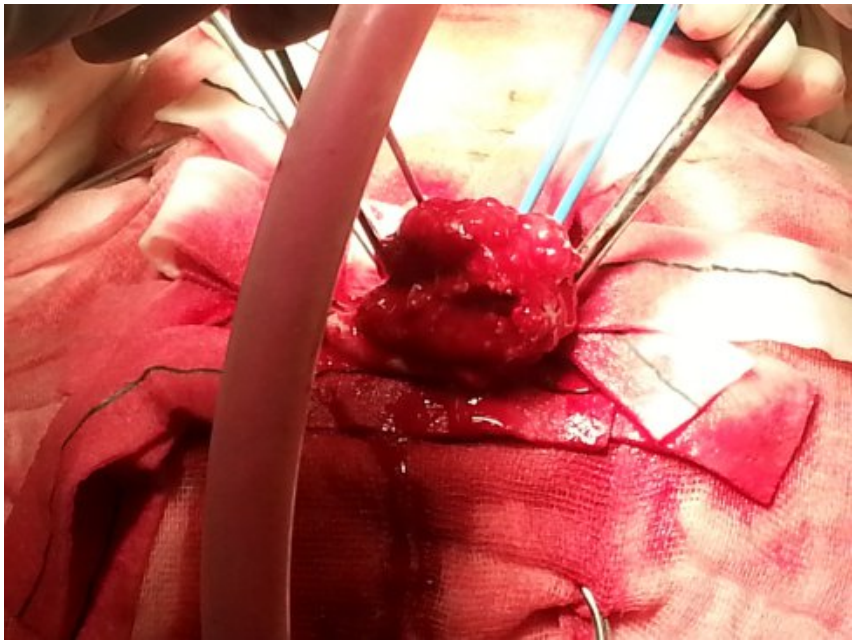


Coronal with contrast



Case 5

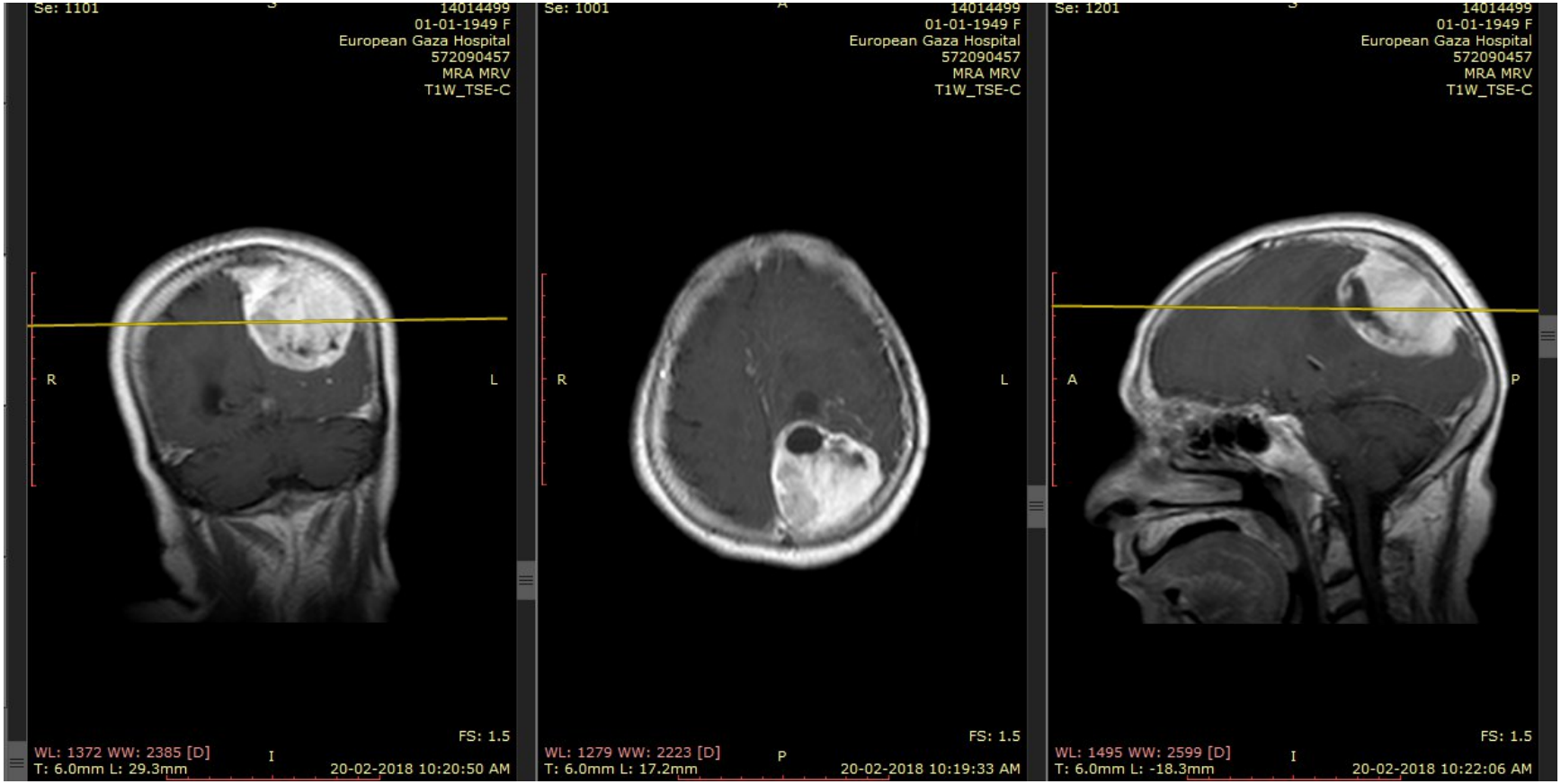
Intraop



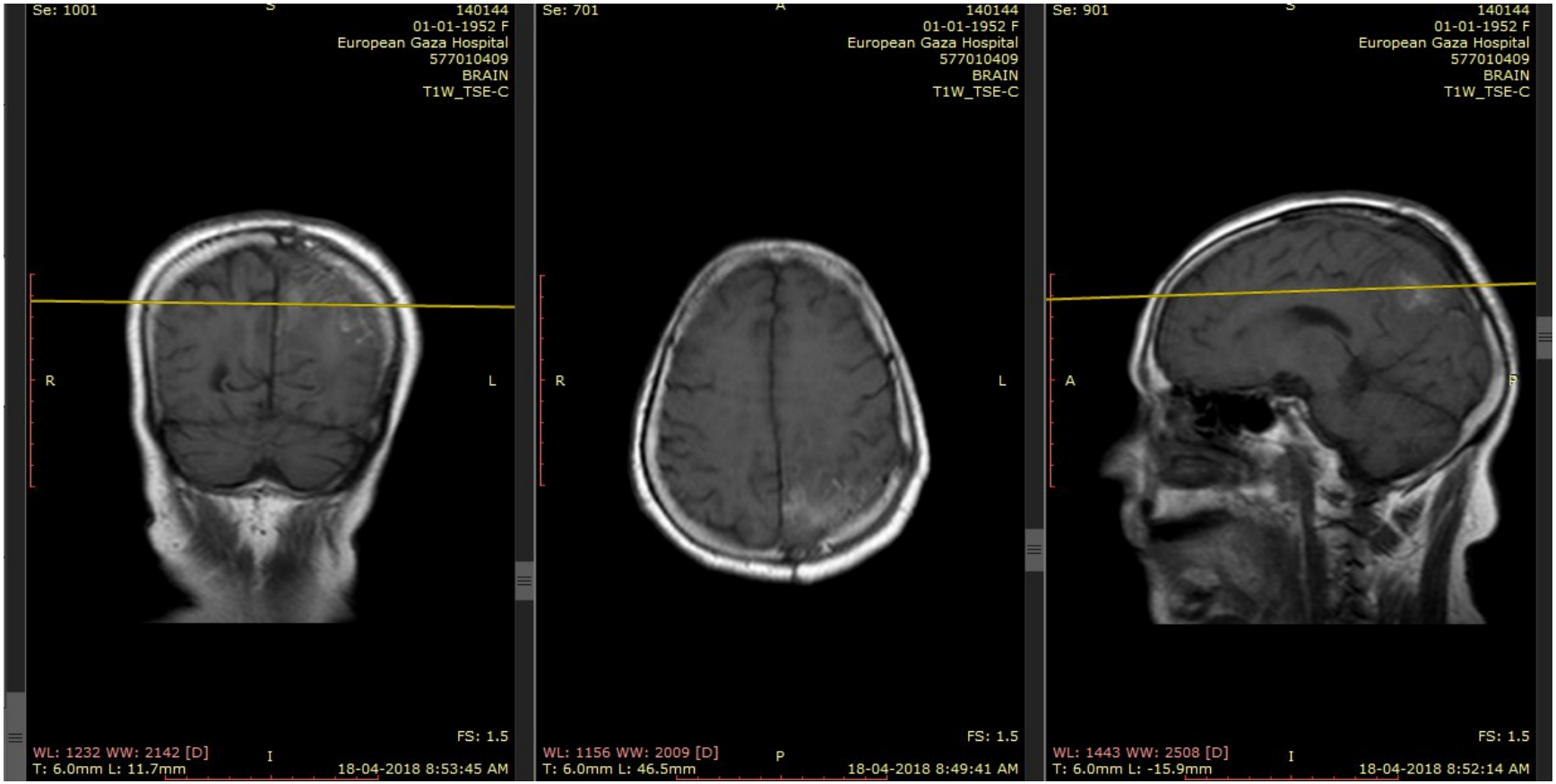
2d day postop



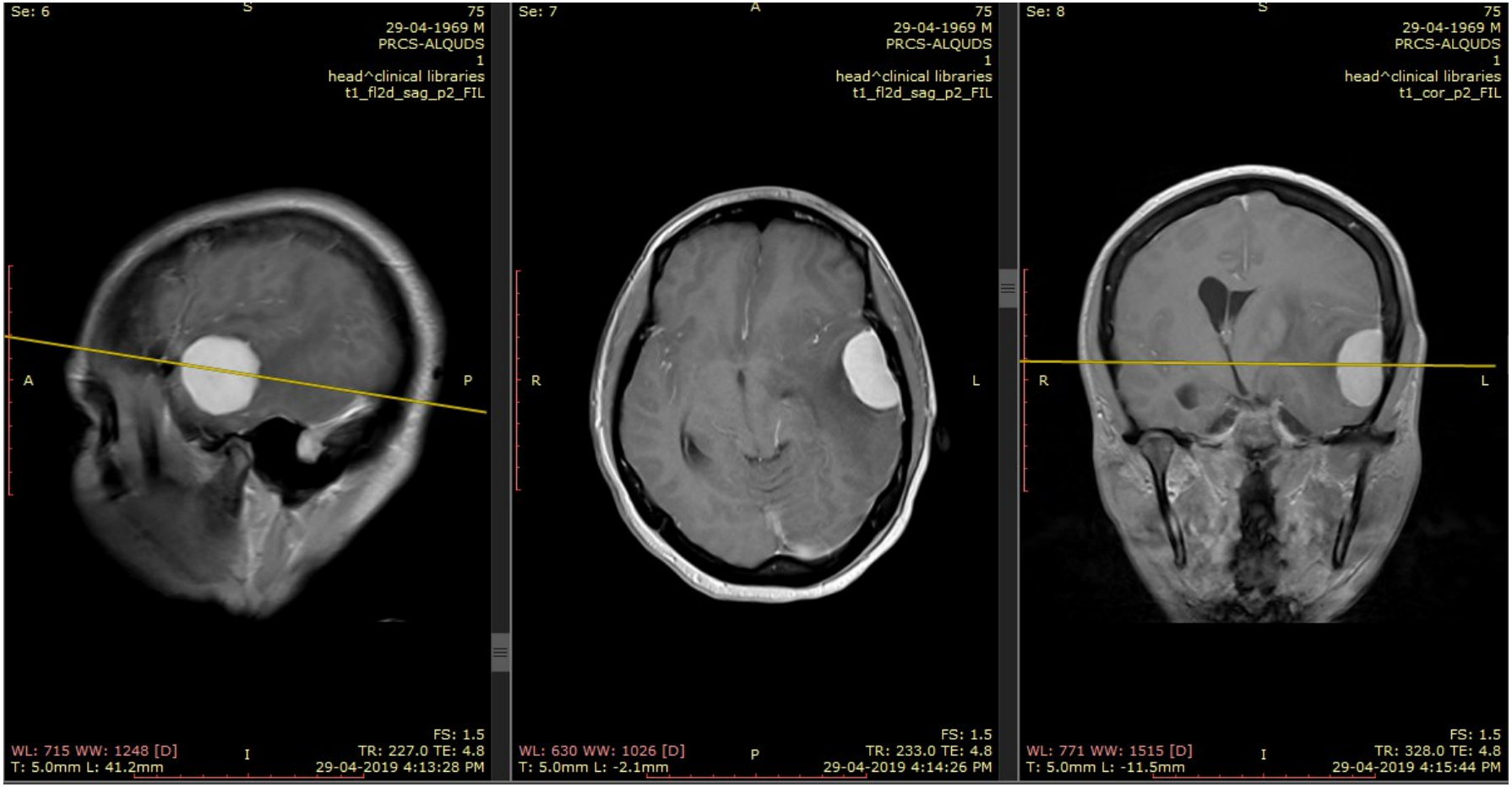
Case 6 Pre


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14014499
01-01-1949 F
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572090457
MRA MRV
T1W_TSE-C
R
L
FS: 1.5
WL: 1372 WW: 2385 [D]
T: 6.0mm L: 29.3mm
I
20-02-2018 10:20:50 AM
Se: 1001
14014499
01-01-1949 F
European Gaza Hospital
572090457
MRA MRV
T1W_TSE-C
R
L
FS: 1.5
WL: 1279 WW: 2223 [D]
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14014499
01-01-1949 F
European Gaza Hospital
572090457
MRA MRV
T1W_TSE-C
A
P
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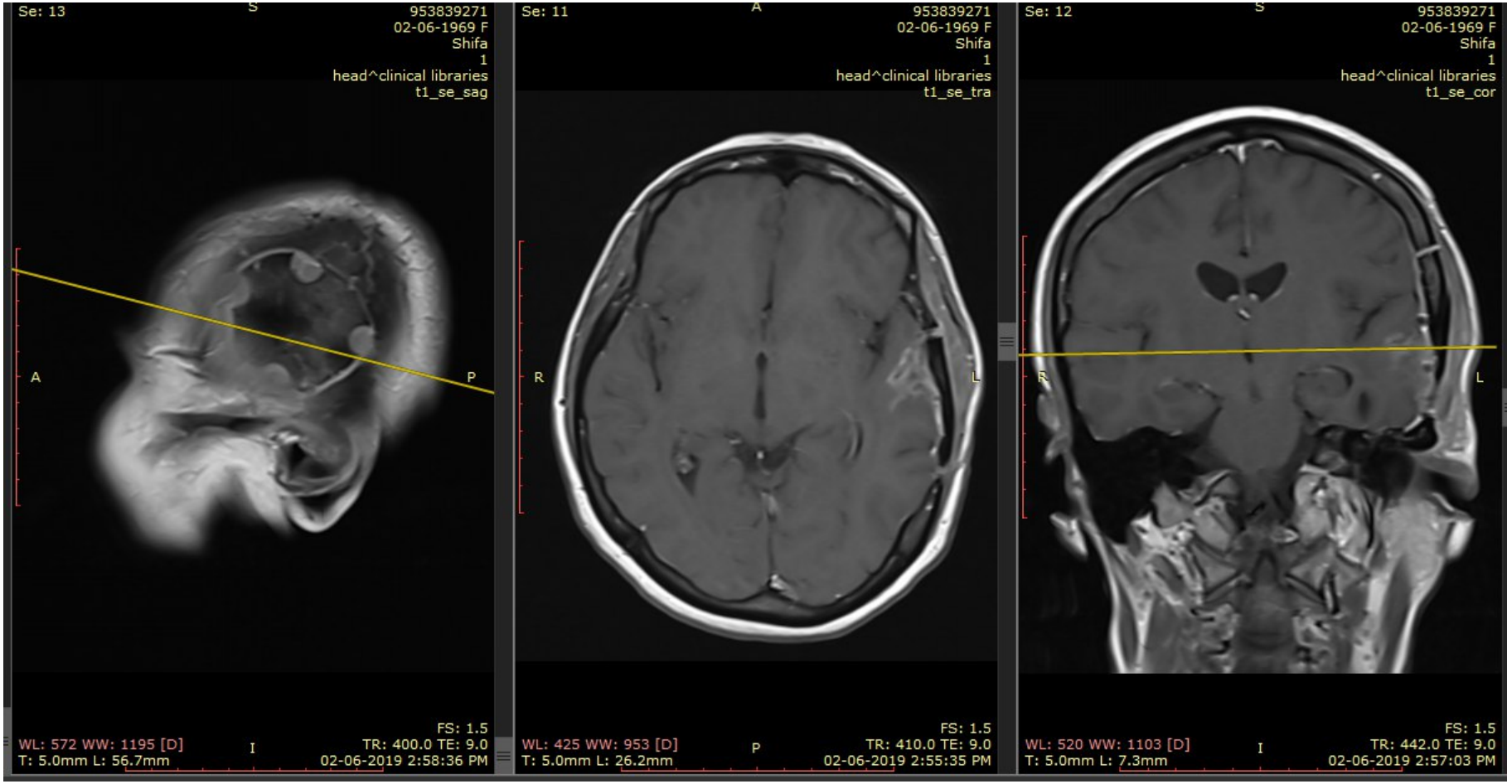
Case 6 Post


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BRAIN
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R
L
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WL: 1232 WW: 2142 [D]
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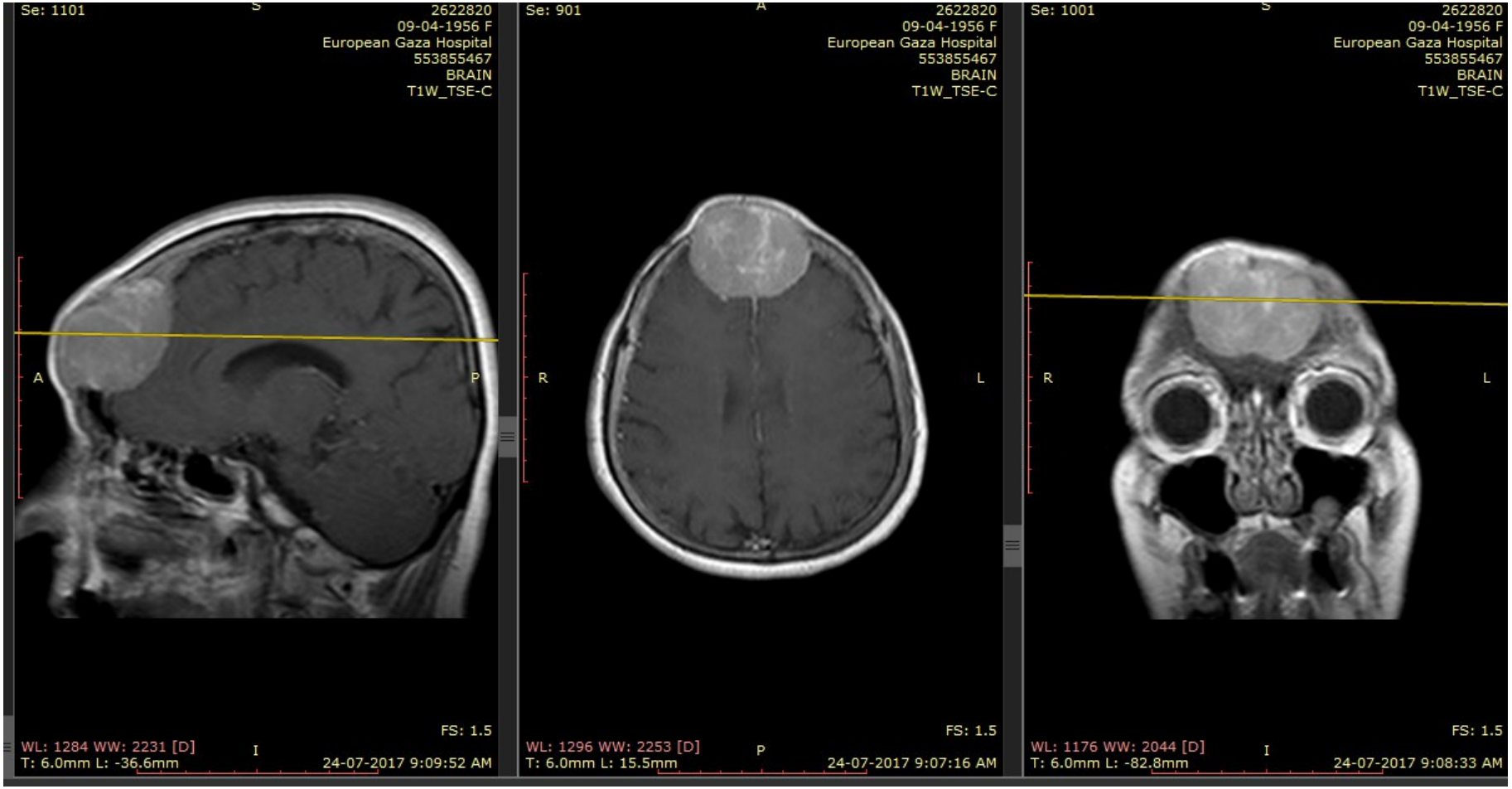
Case 7 Pre


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S
75
29-04-1969 M
PRCS-ALQUDS
1
head^clinical libraries
t1_fl2d_sag_p2_FIL
A
P
FS: 1.5
WL: 715 WW: 1248 [D]
I
TR: 227.0 TE: 4.8
T: 5.0mm L: 41.2mm
29-04-2019 4:13:28 PM
Se: 7
A
75
29-04-1969 M
PRCS-ALQUDS
1
head^clinical libraries
t1_fl2d_sag_p2_FIL
R
L
FS: 1.5
WL: 630 WW: 1026 [D]
P
TR: 233.0 TE: 4.8
T: 5.0mm L: -2.1mm
29-04-2019 4:14:26 PM
Se: 8
S
75
29-04-1969 M
PRCS-ALQUDS
1
head^clinical libraries
t1_cor_p2_FIL
R
L
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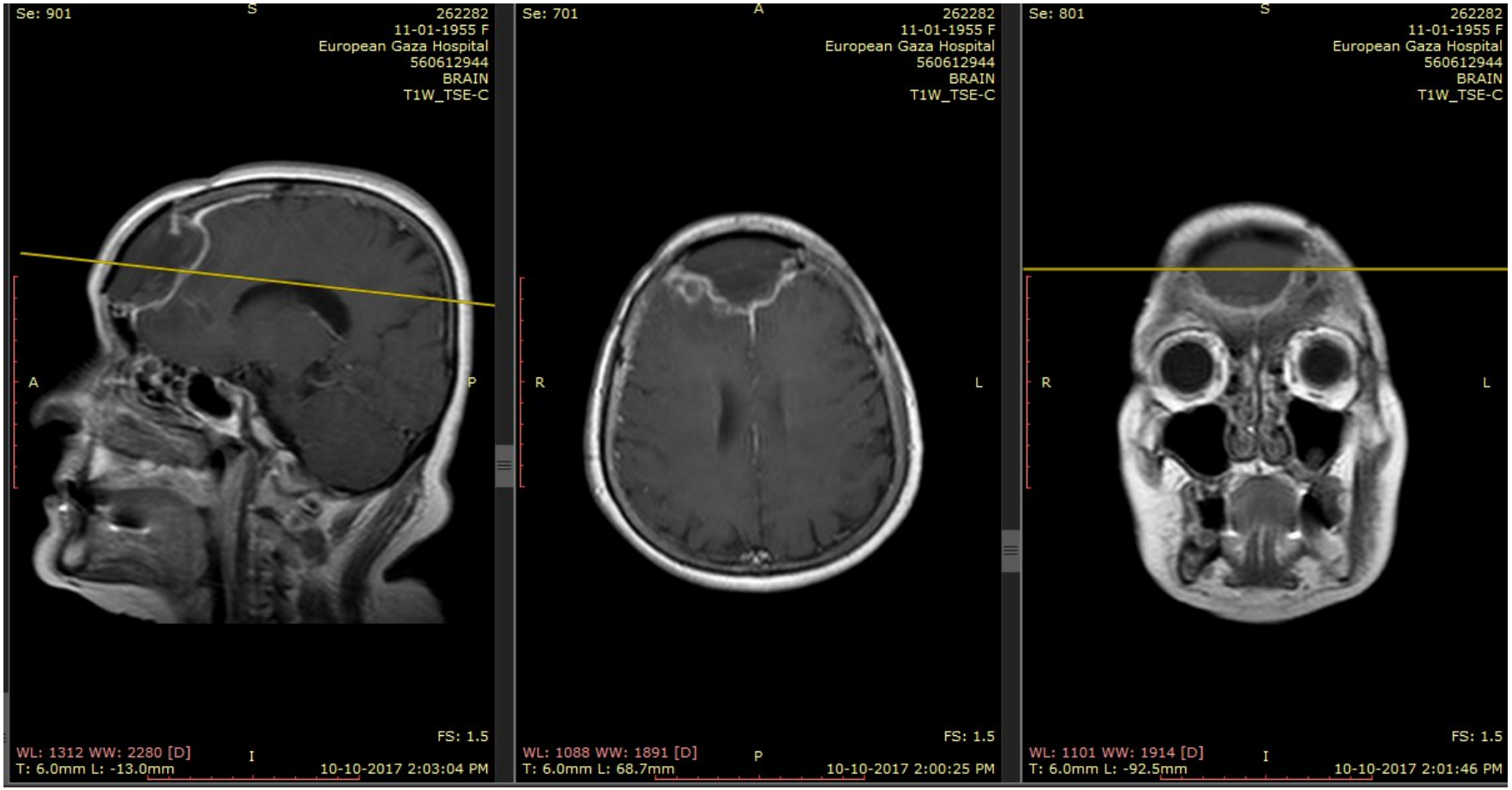
Case 7 Post


Se: 13
S
953839271
02-06-1969 F
Shifa
1
head^clinical libraries
t1_se_sag
A
P
FS: 1.5
WL: 572 WW: 1195 [D]
TR: 400.0 TE: 9.0
T: 5.0mm L: 56.7mm
I
02-06-2019 2:58:36 PM
Se: 11
A
953839271
02-06-1969 F
Shifa
1
head^clinical libraries
t1_se_tra
R
L
FS: 1.5
WL: 425 WW: 953 [D]
TR: 410.0 TE: 9.0
T: 5.0mm L: 26.2mm
P
02-06-2019 2:55:35 PM
Se: 12
S
953839271
02-06-1969 F
Shifa
1
head^clinical libraries
t1_se_cor
R
L
FS: 1.5
WL: 520 WW: 1103 [D]
TR: 442.0 TE: 9.0
T: 5.0mm L: 7.3mm
I
02-06-2019 2:57:03 PM

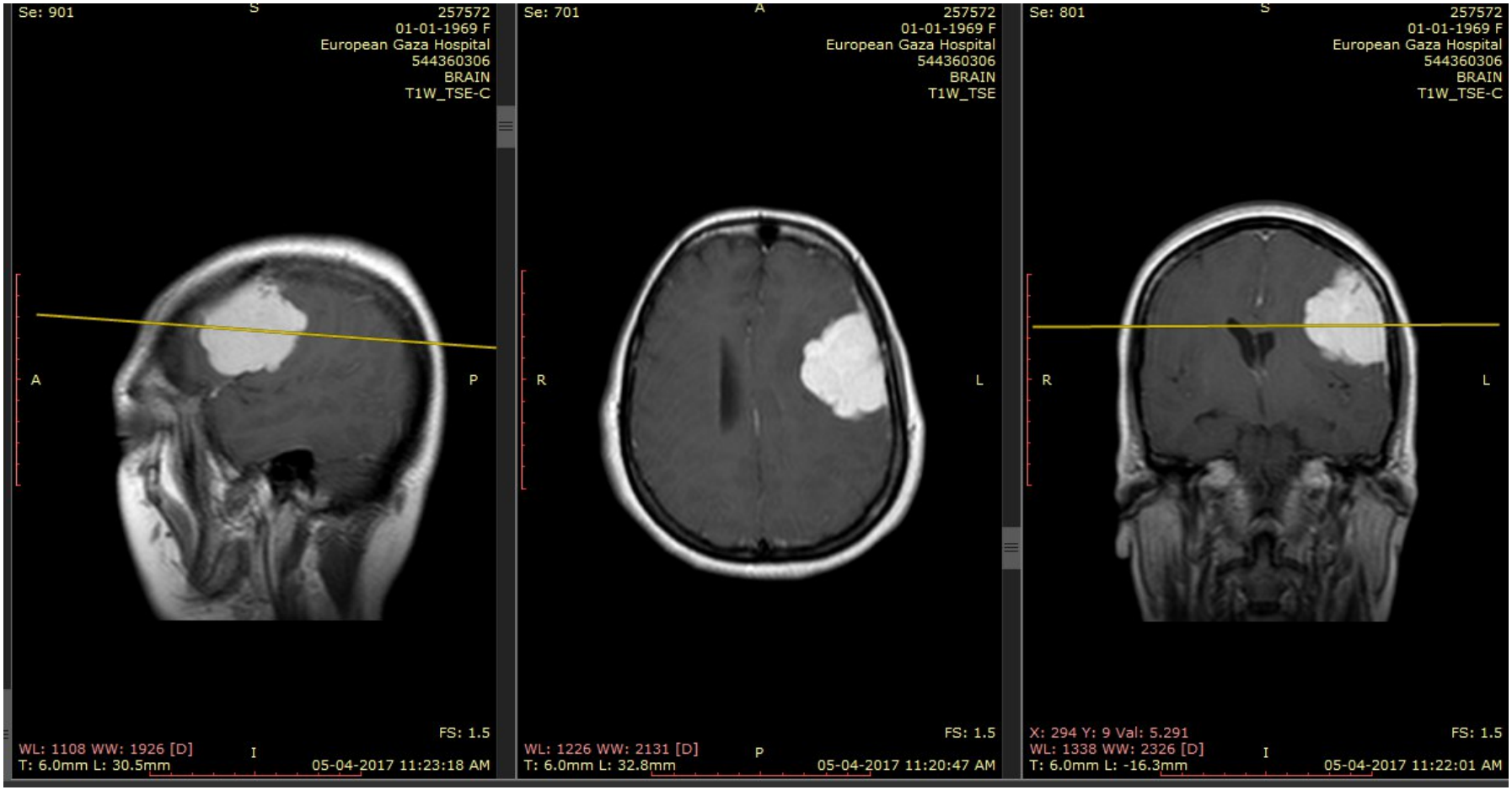
Case 8 Pre


Se: 1101
2622820
09-04-1956 F
European Gaza Hospital
553855467
BRAIN
T1W_TSE-C
A
P
FS: 1.5
WL: 1284 WW: 2231 [D]
T: 6.0mm L: -36.6mm
I
24-07-2017 9:09:52 AM
Se: 901
2622820
09-04-1956 F
European Gaza Hospital
553855467
BRAIN
T1W_TSE-C
R
L
FS: 1.5
WL: 1296 WW: 2253 [D]
T: 6.0mm L: 15.5mm
P
24-07-2017 9:07:16 AM
Se: 1001
2622820
09-04-1956 F
European Gaza Hospital
553855467
BRAIN
T1W_TSE-C
R
L
FS: 1.5
WL: 1176 WW: 2044 [D]
T: 6.0mm L: -82.8mm
I
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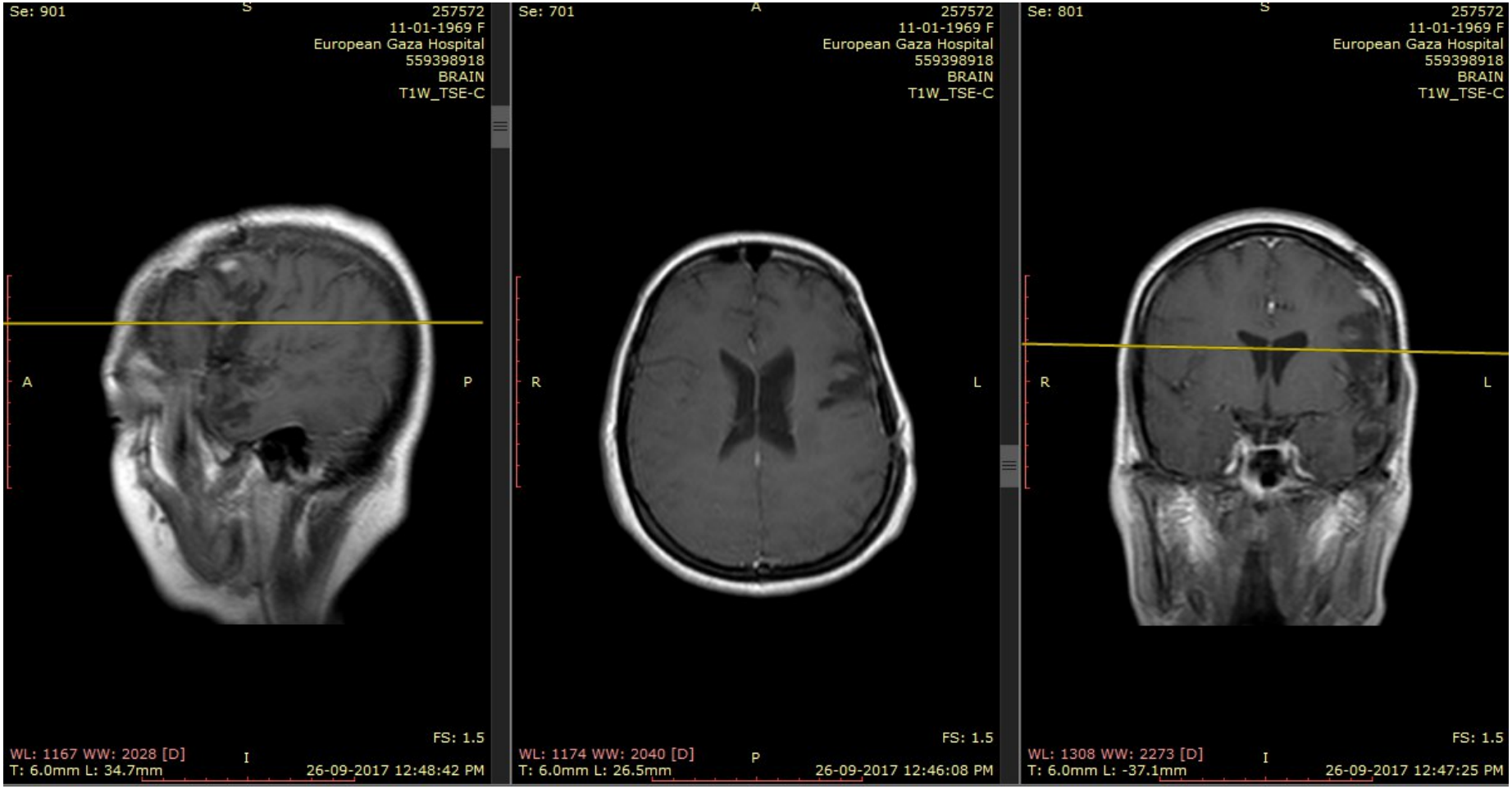
Case 8 Post


Se: 901
S
262282
11-01-1955 F
European Gaza Hospital
560612944
BRAIN
T1W_TSE-C
A
P
FS: 1.5
WL: 1312 WW: 2280 [D]
T: 6.0mm L: -13.0mm
I
10-10-2017 2:03:04 PM
Se: 701
A
262282
11-01-1955 F
European Gaza Hospital
560612944
BRAIN
T1W_TSE-C
R
L
FS: 1.5
WL: 1088 WW: 1891 [D]
T: 6.0mm L: 68.7mm
P
10-10-2017 2:00:25 PM
Se: 801
S
262282
11-01-1955 F
European Gaza Hospital
560612944
BRAIN
T1W_TSE-C
R
L
FS: 1.5
WL: 1101 WW: 1914 [D]
T: 6.0mm L: -92.5mm
I
10-10-2017 2:01:46 PM

Case 9 Pre


Se: 901
S
257572
01-01-1969 F
European Gaza Hospital
544360306
BRAIN
T1W_TSE-C
A
P
FS: 1.5
WL: 1108 WW: 1926 [D]
T: 6.0mm L: 30.5mm
I
05-04-2017 11:23:18 AM
Se: 701
A
257572
01-01-1969 F
European Gaza Hospital
544360306
BRAIN
T1W_TSE
R
L
FS: 1.5
WL: 1226 WW: 2131 [D]
T: 6.0mm L: 32.8mm
P
05-04-2017 11:20:47 AM
Se: 801
S
257572
01-01-1969 F
European Gaza Hospital
544360306
BRAIN
T1W_TSE-C
R
L
X: 294 Y: 9 Val: 5.291
WL: 1338 WW: 2326 [D]
T: 6.0mm L: -16.3mm
FS: 1.5
I
05-04-2017 11:22:01 AM

Case 9 Post


Se: 901
S
257572
11-01-1969 F
European Gaza Hospital
559398918
BRAIN
T1W_TSE-C
A
P
FS: 1.5
WL: 1167 WW: 2028 [D]
T: 6.0mm L: 34.7mm
I
26-09-2017 12:48:42 PM
Se: 701
A
257572
11-01-1969 F
European Gaza Hospital
559398918
BRAIN
T1W_TSE-C
R
L
FS: 1.5
WL: 1174 WW: 2040 [D]
T: 6.0mm L: 26.5mm
P
26-09-2017 12:46:08 PM
Se: 801
S
257572
11-01-1969 F
European Gaza Hospital
559398918
BRAIN
T1W_TSE-C
R
L
FS: 1.5
WL: 1308 WW: 2273 [D]
T: 6.0mm L: -37.1mm
I
26-09-2017 12:47:25 PM

Thanks



Any Questions?