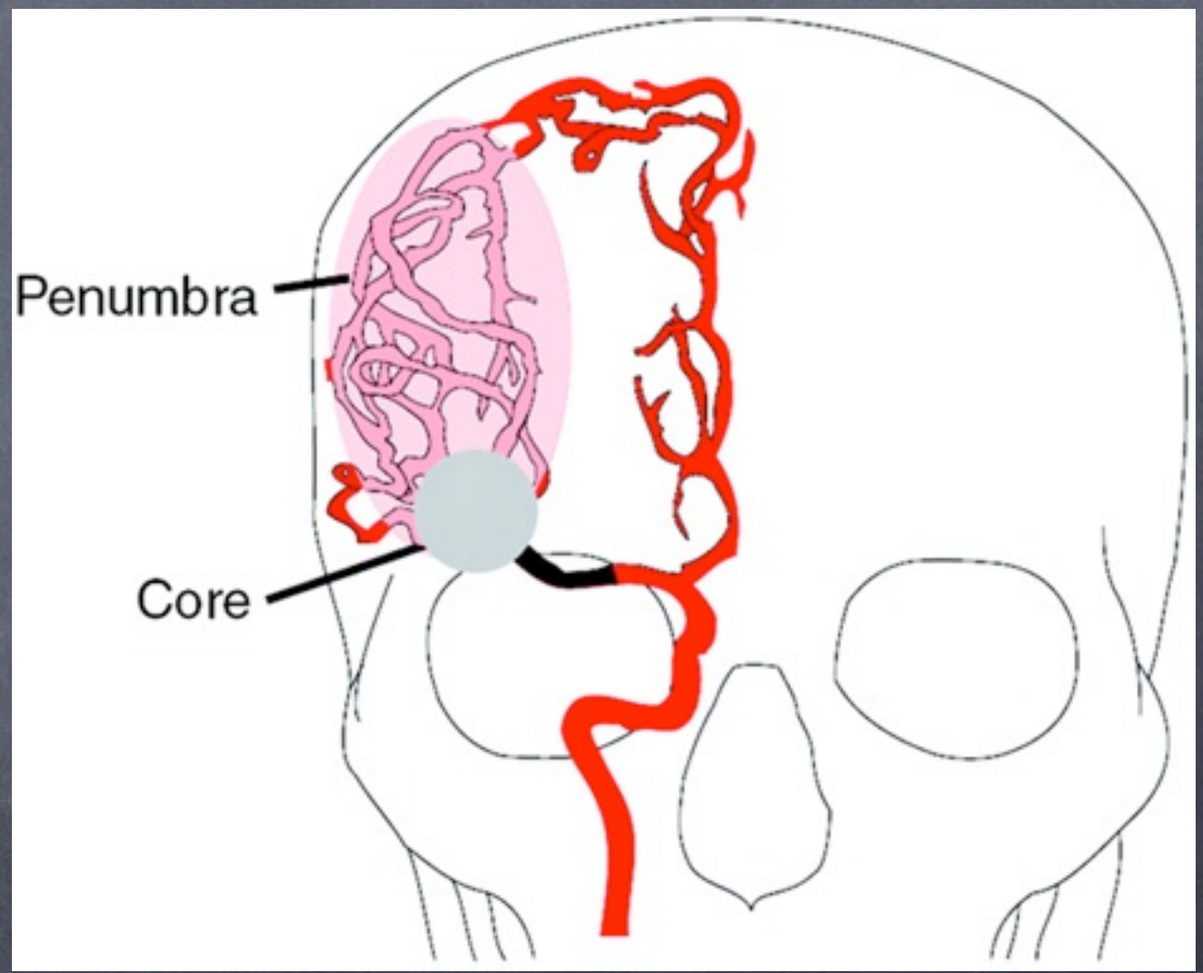
Stroke Imaging

Jacob Lee, MD

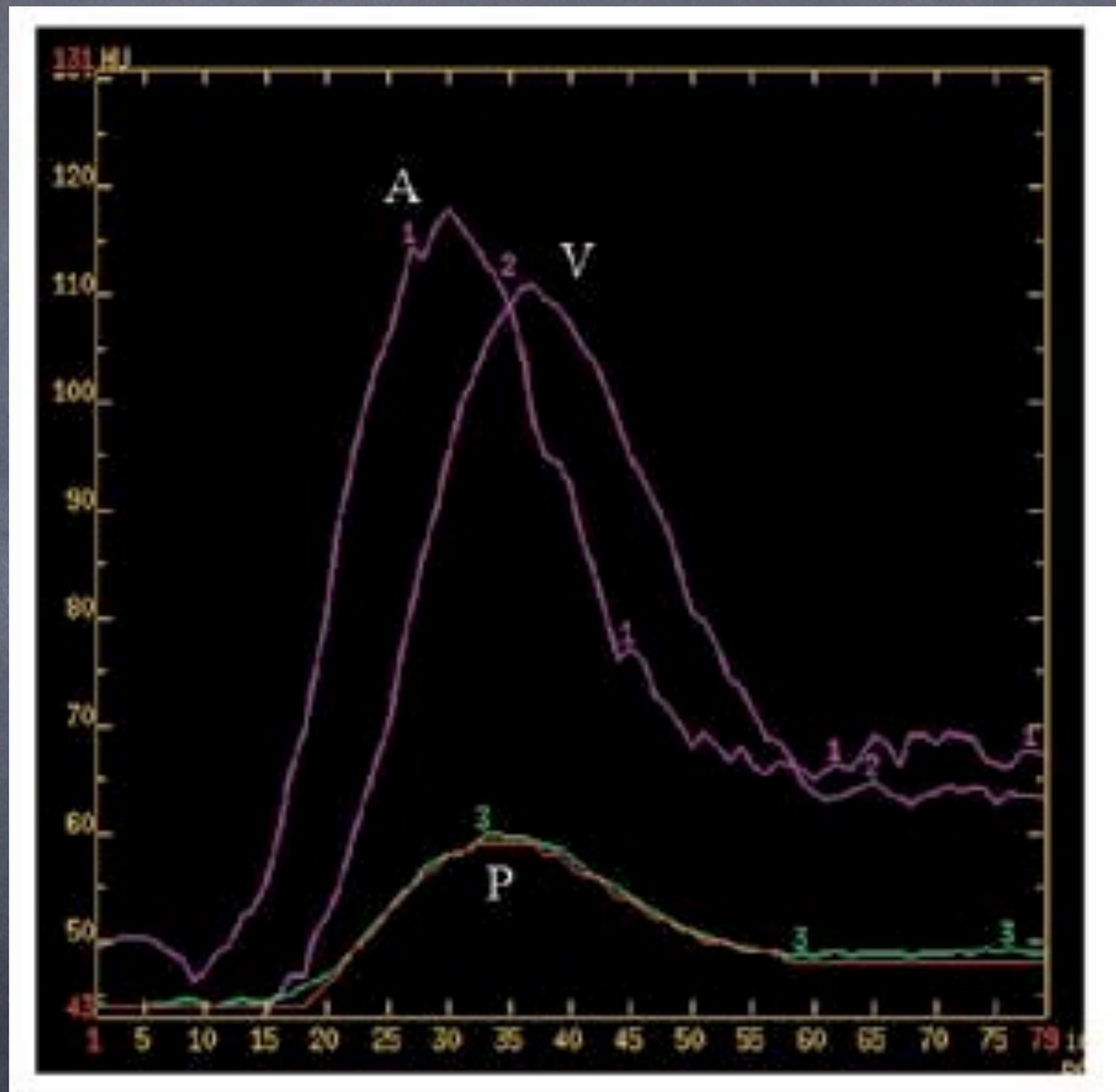
Stroke Protocol summary

- Parenchyma - CT Head without contrast
- Pipe - CTA from arch to vertex
- Perfusion - CTP from orbital roof to vertex
- Penumbra - derived from CBF CBV mismatch

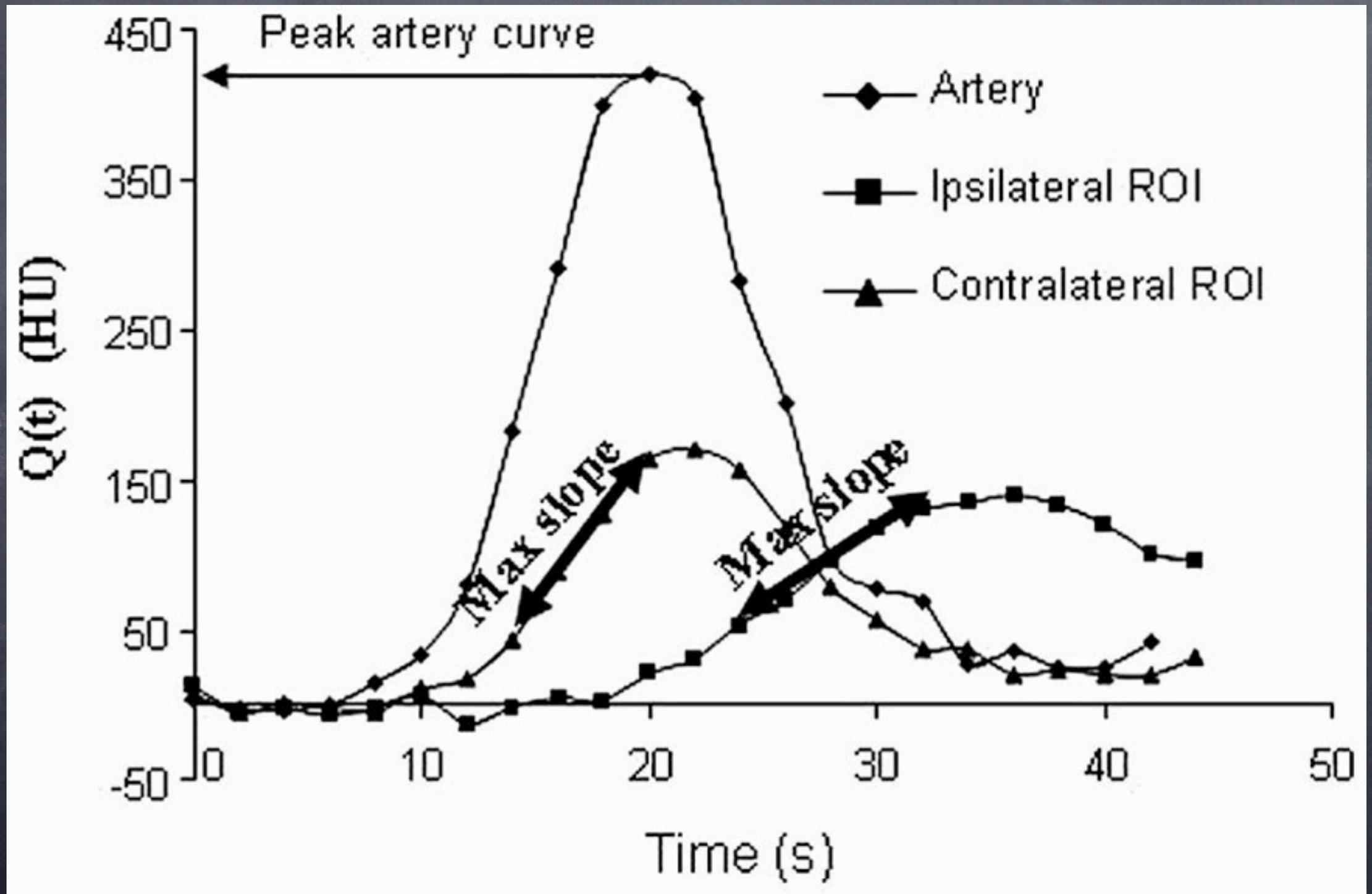


Time Density Curve

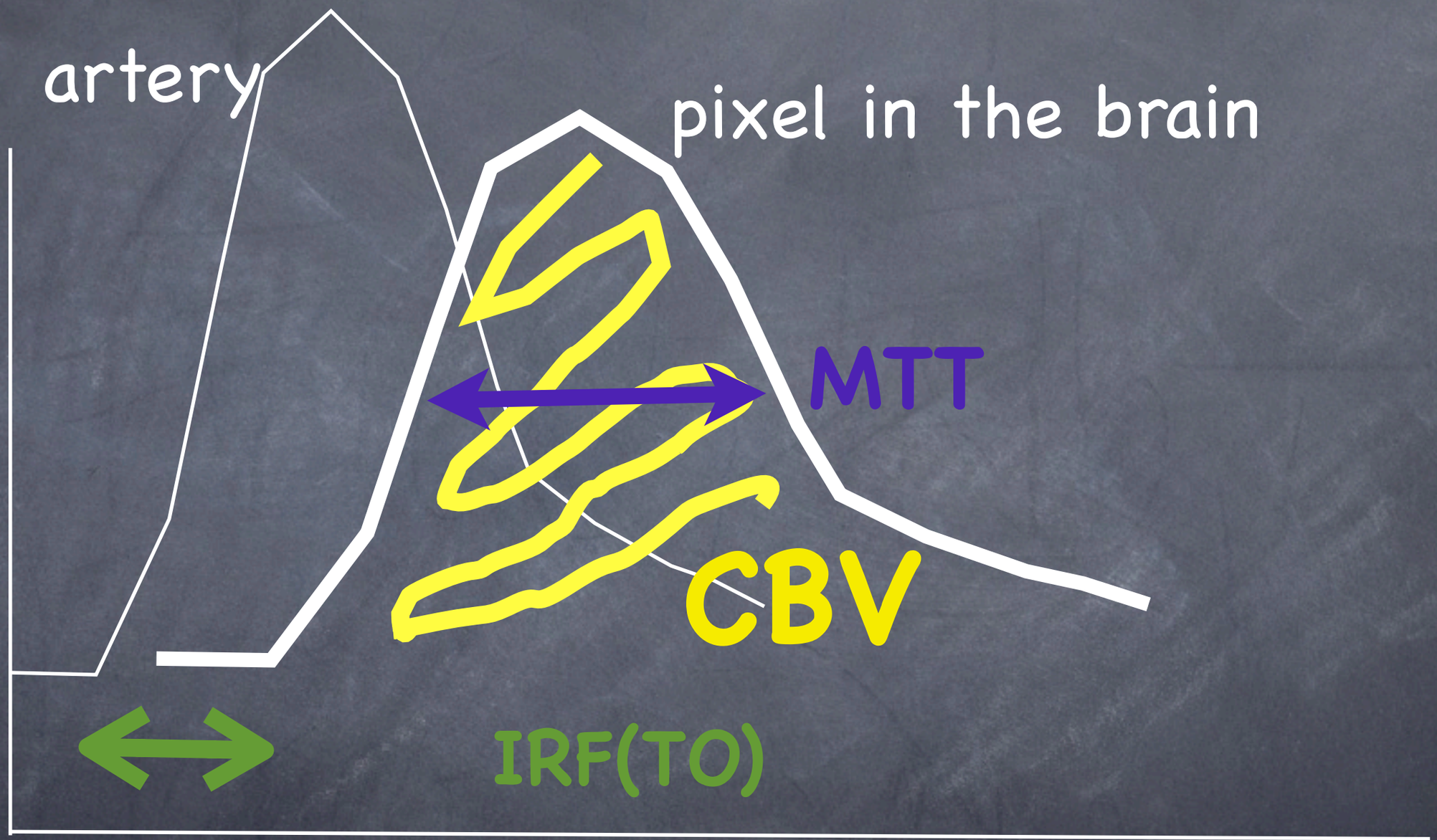
- Pick artery or vein
- This should be sent to you.
- Quality of injection
- Duration of scanning
- Proper A, V placement.



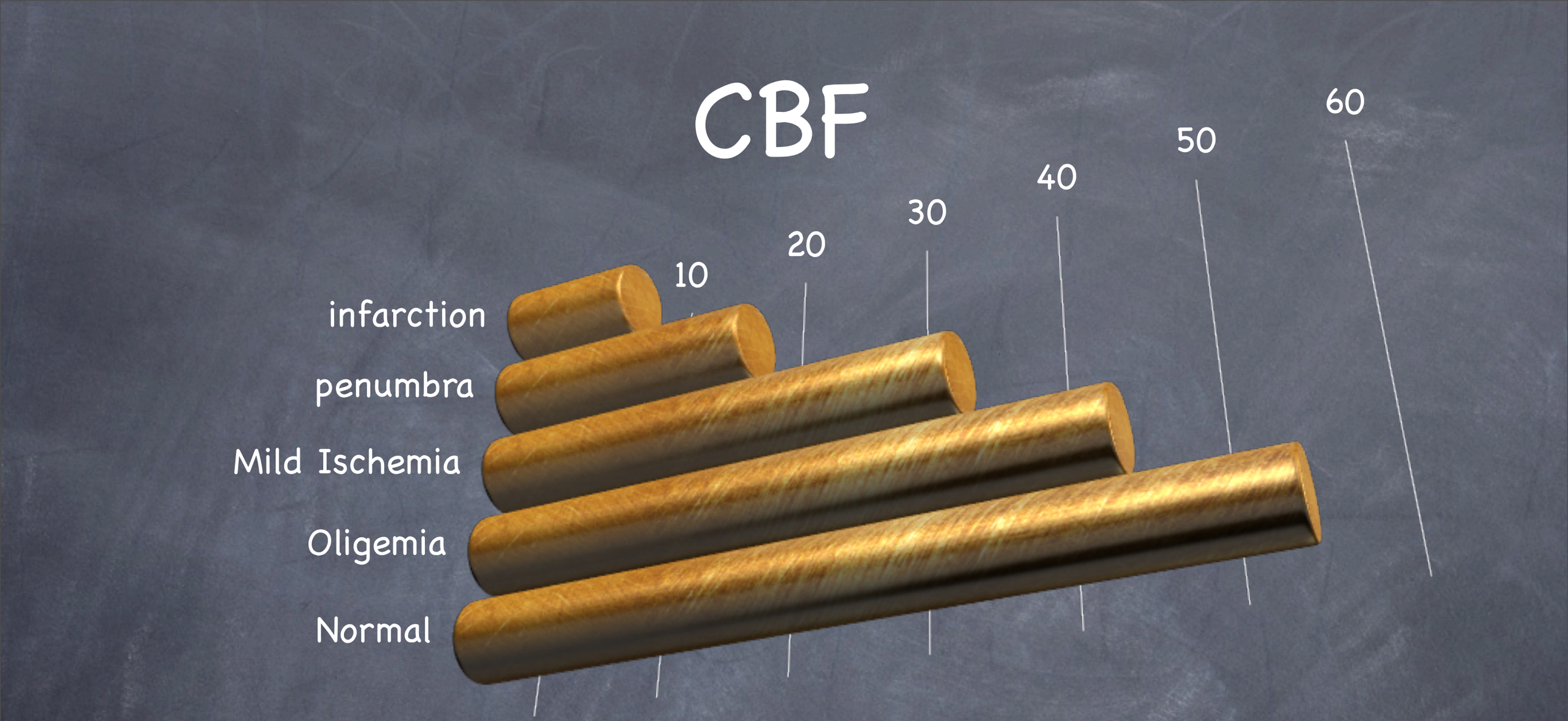
TDC of ischemic tissue



Perfusion Maps are derived from TDC

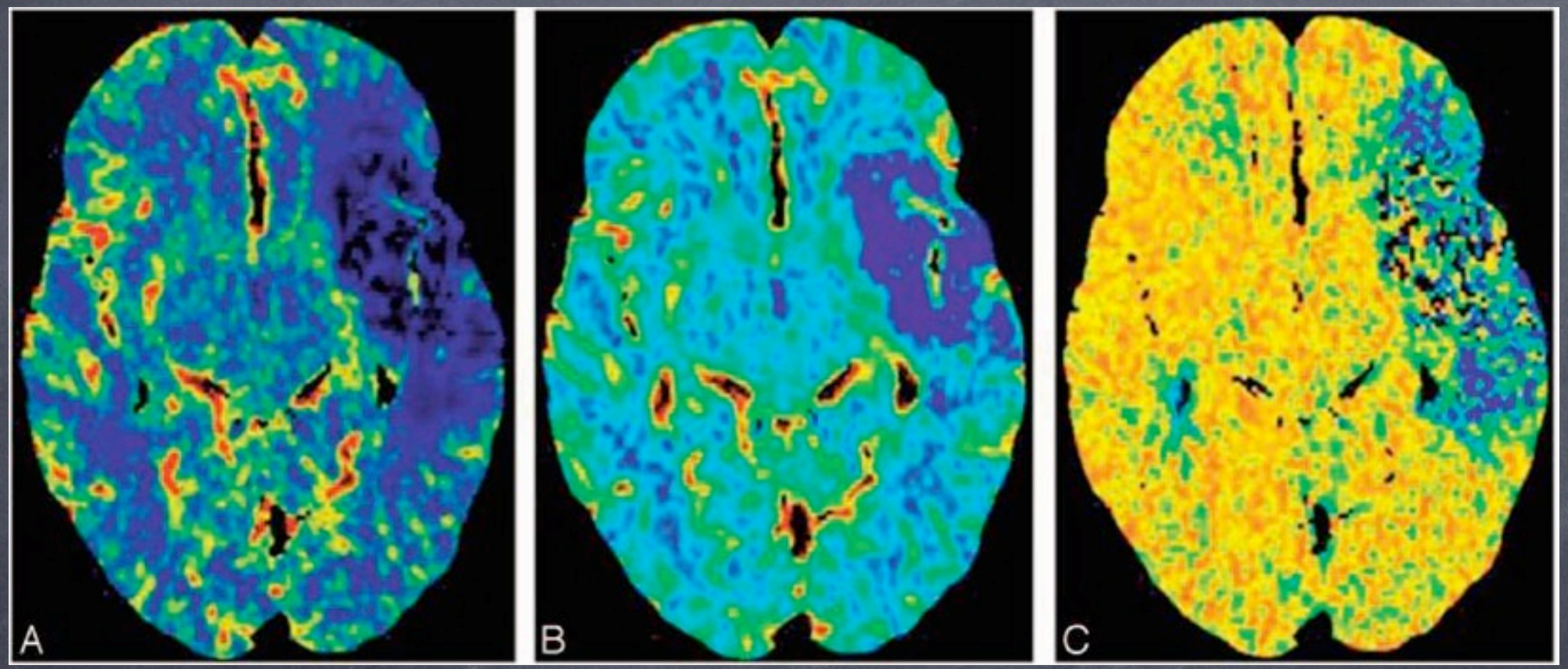


CBF = CBV / MTT



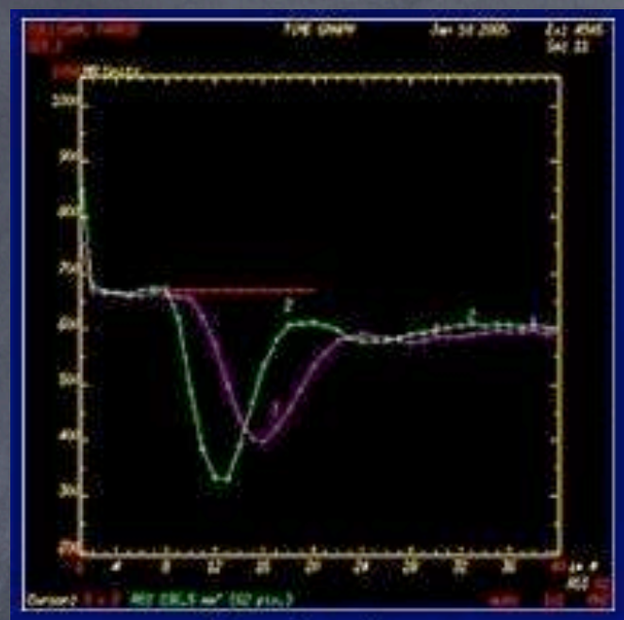
< 10 *infarct* (dead)
10-20 *penumbra* (NO electrical activity)
20-35 *mild ischemia* (anerobic glycolysis)
35-45 *oligemia* (autoregulated vessels)
45-55 *normal*

CTP- Penumbra

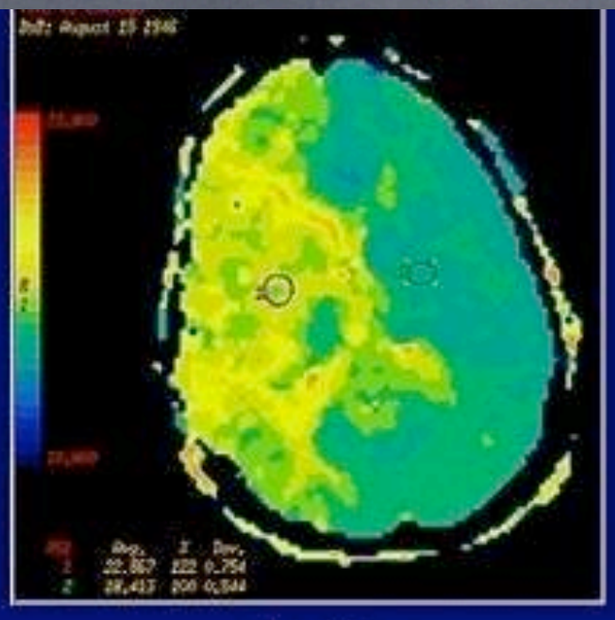


CBF CBV MTT

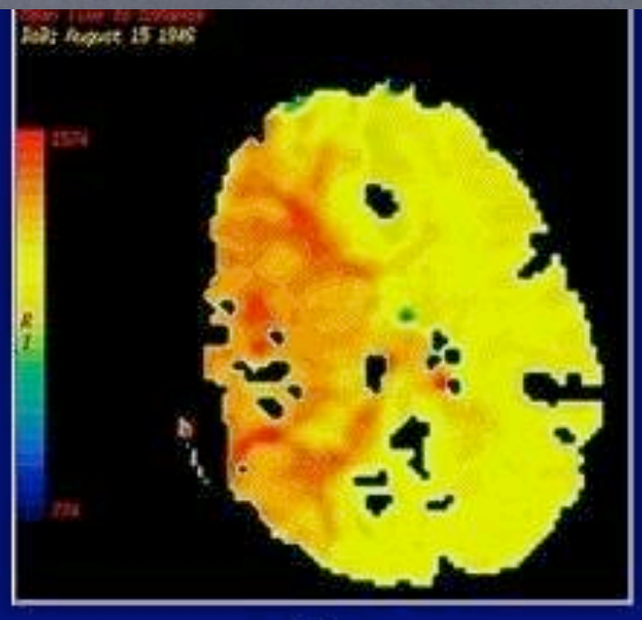
MR perfusion



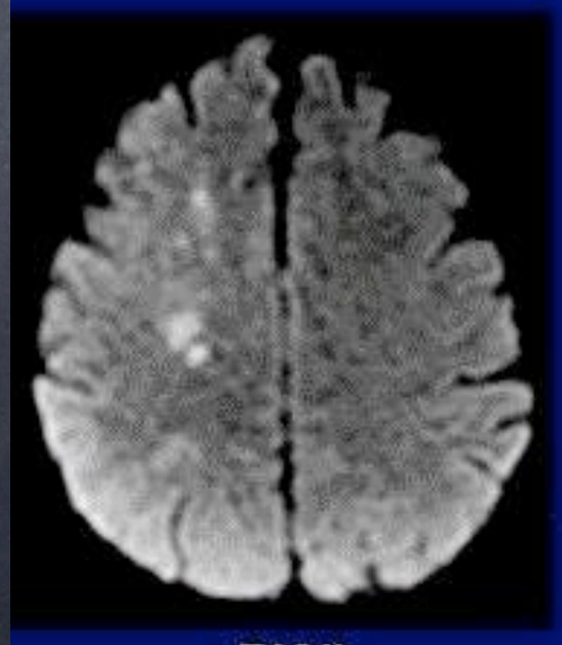
Perfusion



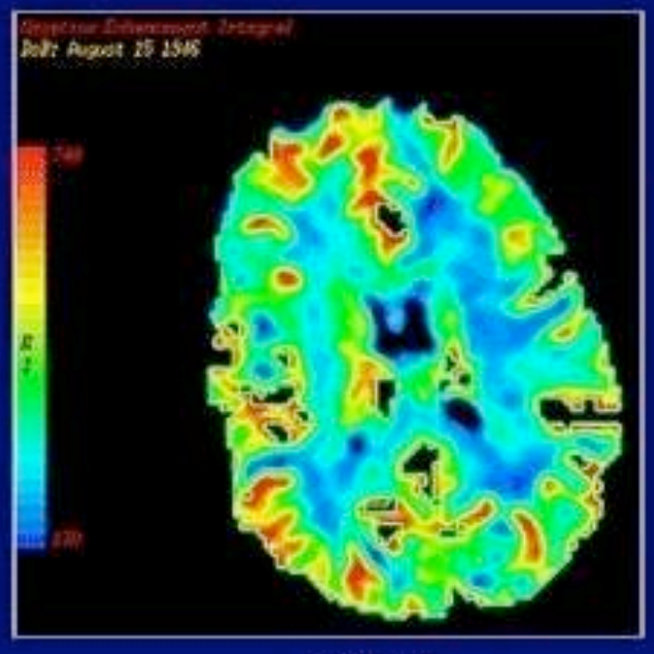
TTP



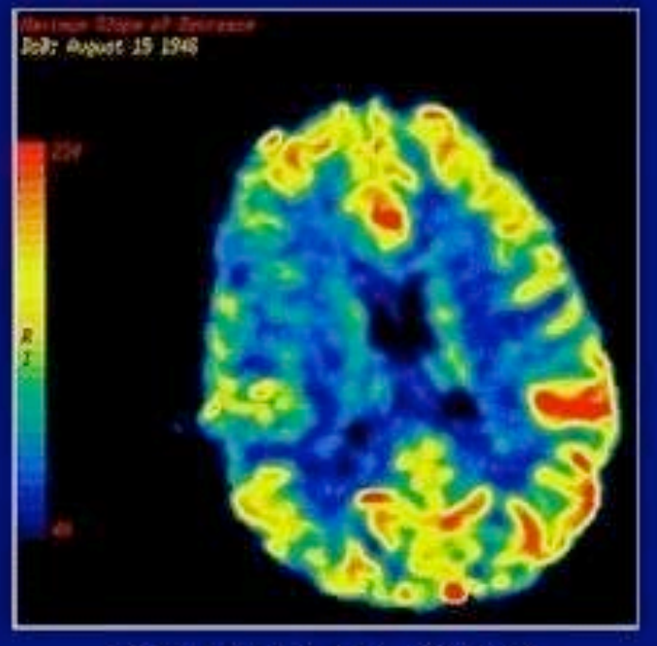
rMTT



DWI

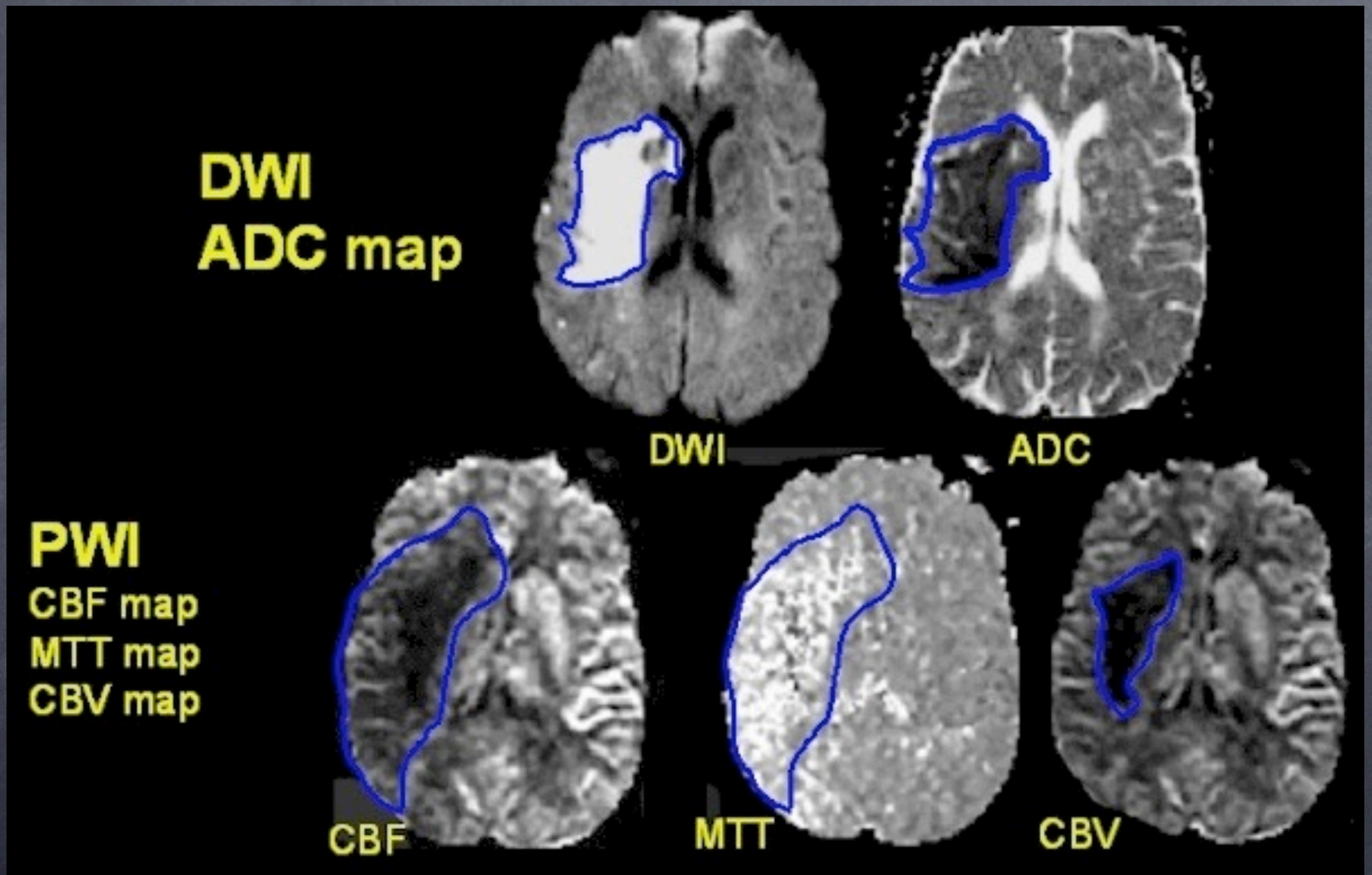


rCBV



CBV/MTT=rCBF

MR dwi-pwi mismatch

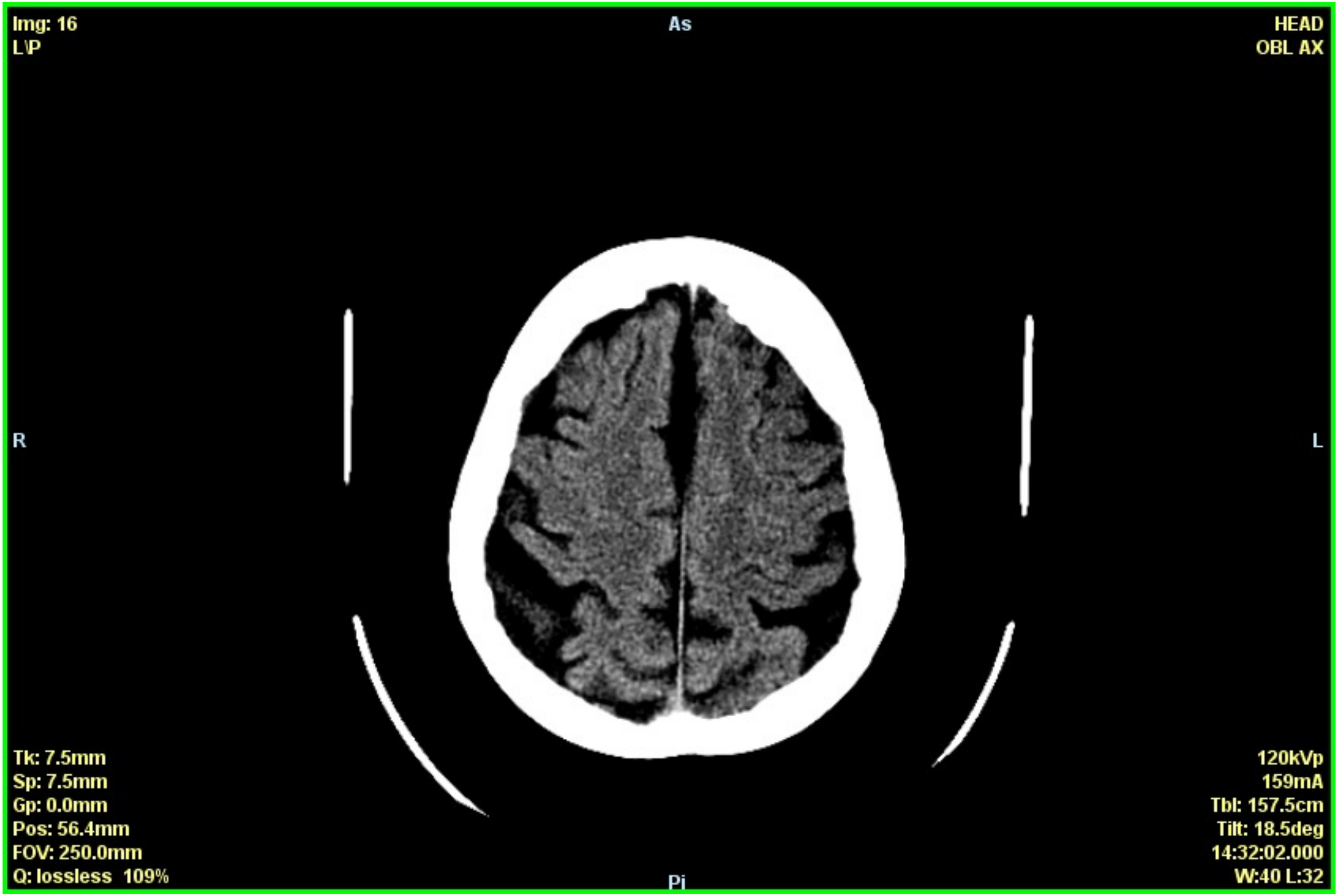


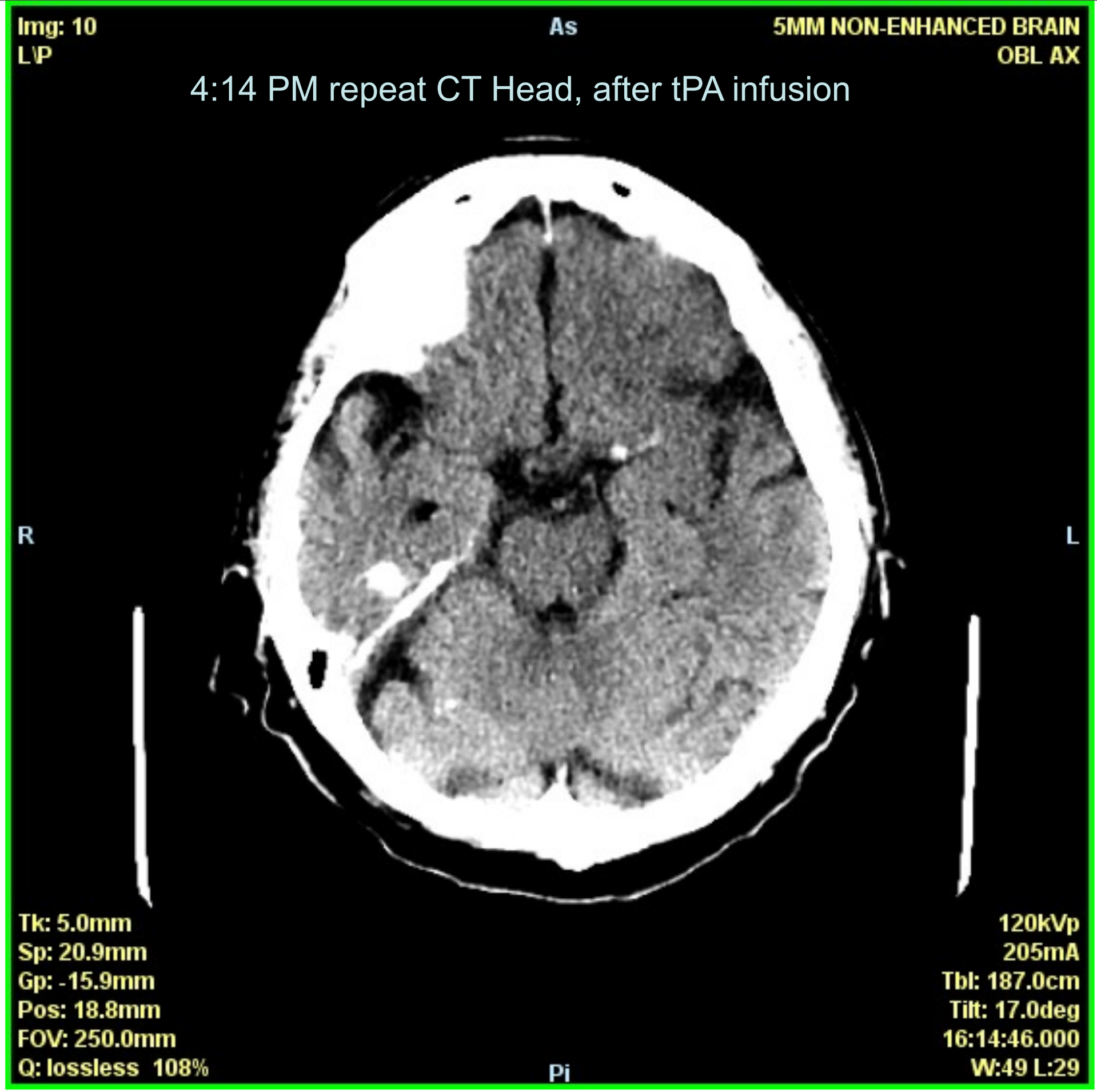
first patient

2:30 PM. CT Head. 87yo F. found unresponsive. Pt was normal at noon.

2:30 PM. CT Head. R/O BLEED

2:30 PM. CT Head. R/O BLEED



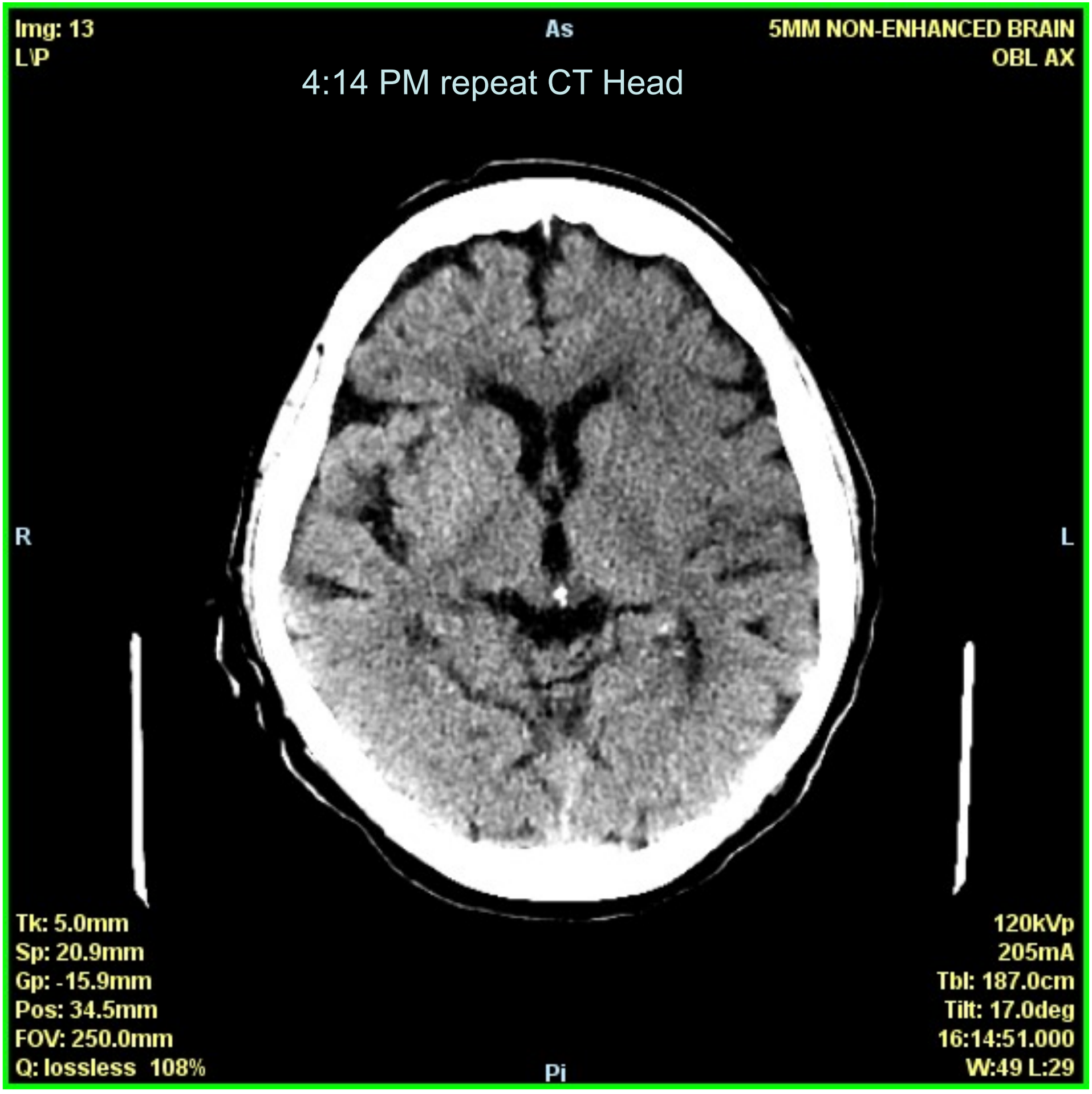

Img: 10
L\P
As
5MM NON-ENHANCED BRAIN
OBL AX
4:14 PM repeat CT Head, after tPA infusion
R
L
Tk: 5.0mm
Sp: 20.9mm
Gp: -15.9mm
Pos: 18.8mm
FOV: 250.0mm
Q: lossless 108%
Pi
120kVp
205mA
Tbl: 187.0cm
Tilt: 17.0deg
16:14:46.000
W:49 L:29

Img: 13
L\P

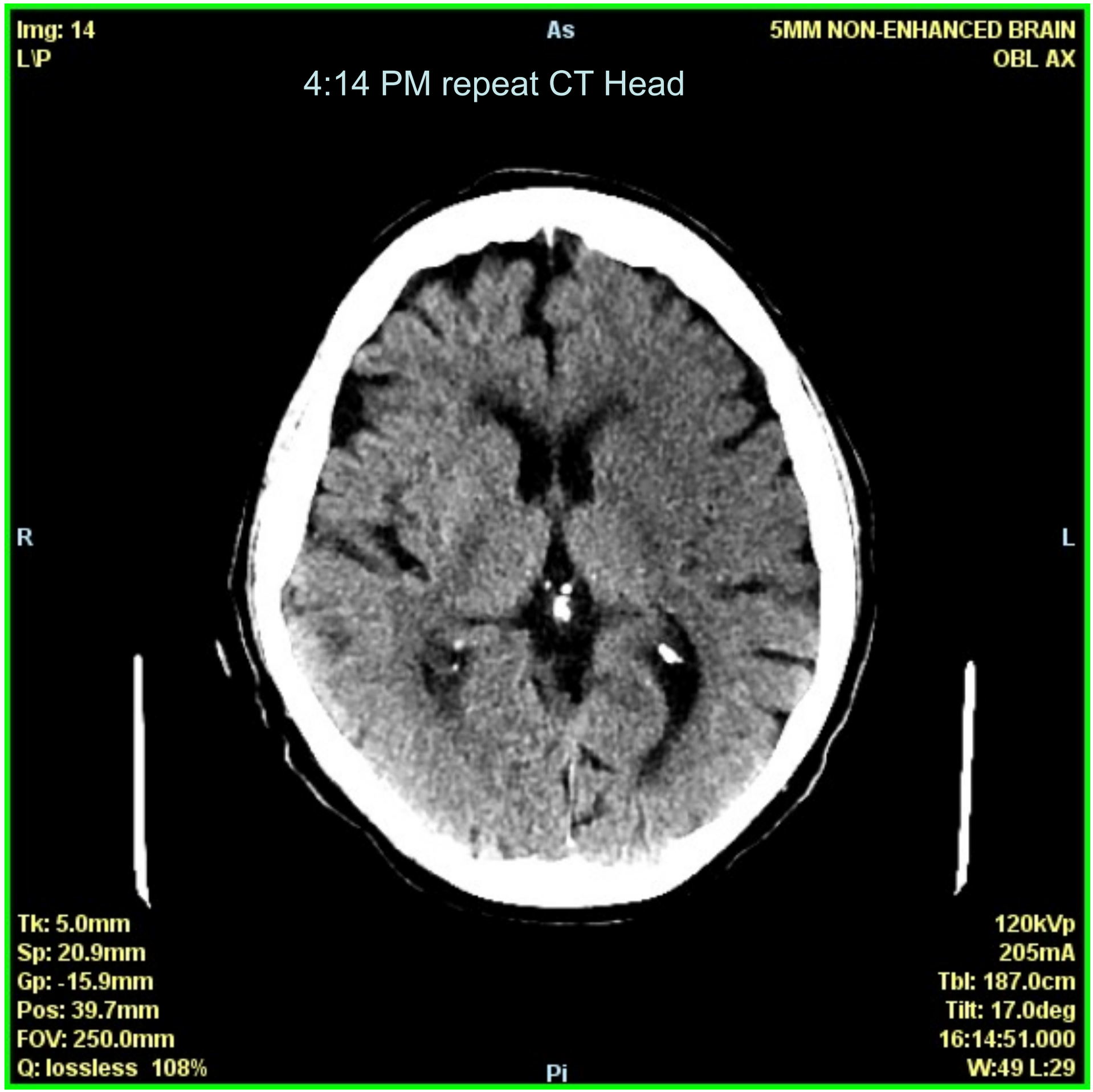
As

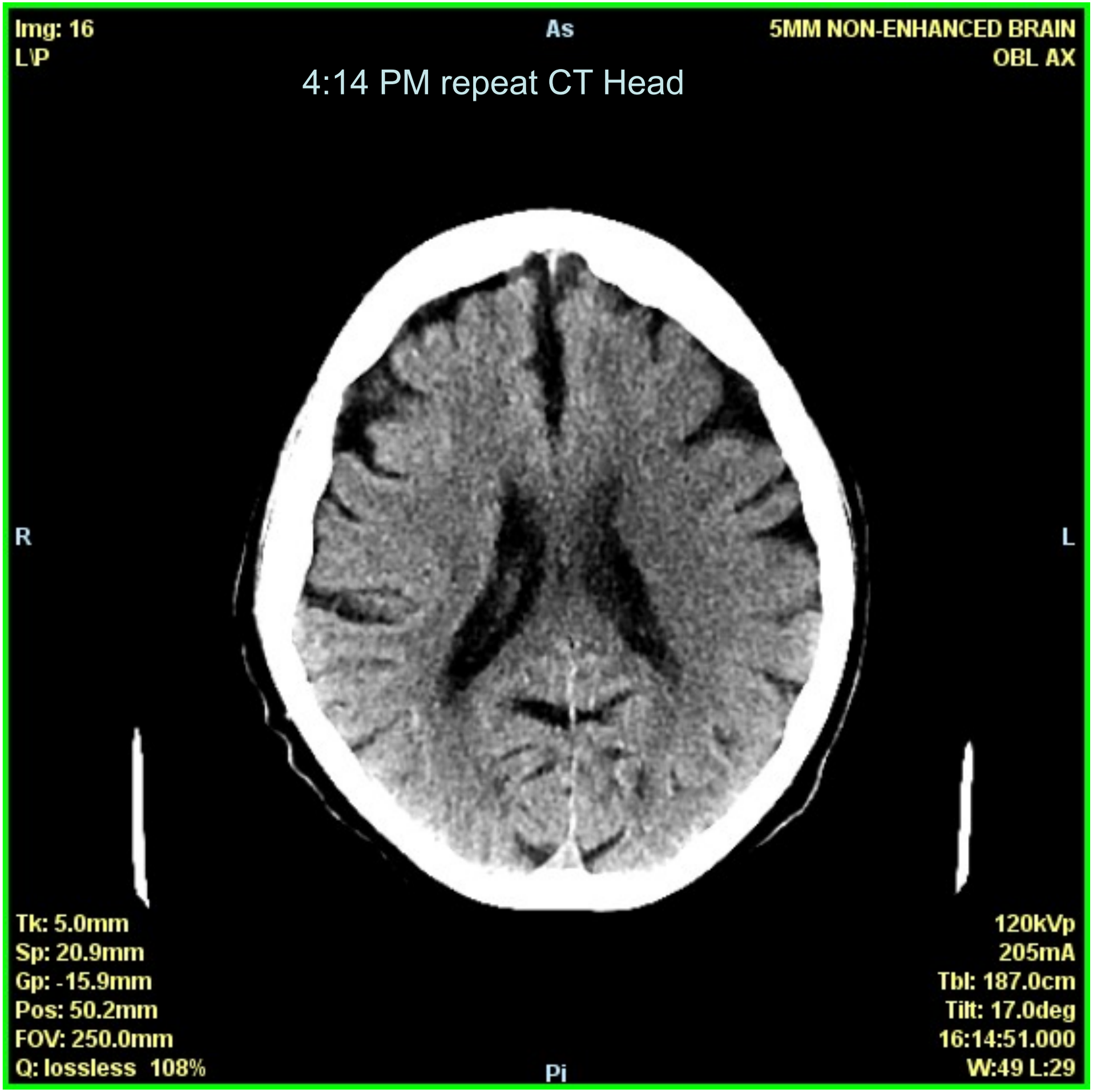
5MM NON-ENHANCED BRAIN
OBL AX

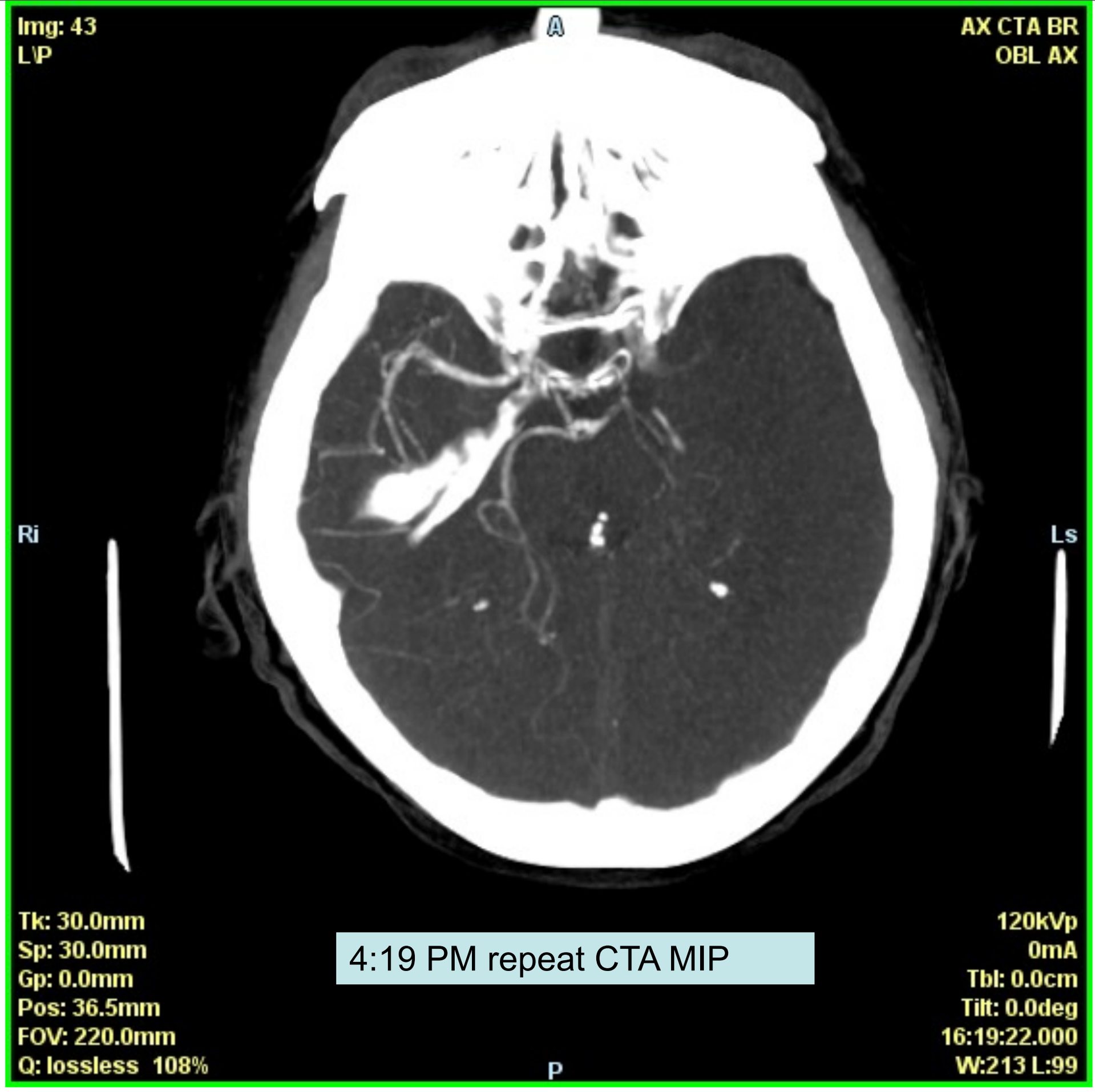
4:14 PM repeat CT Head

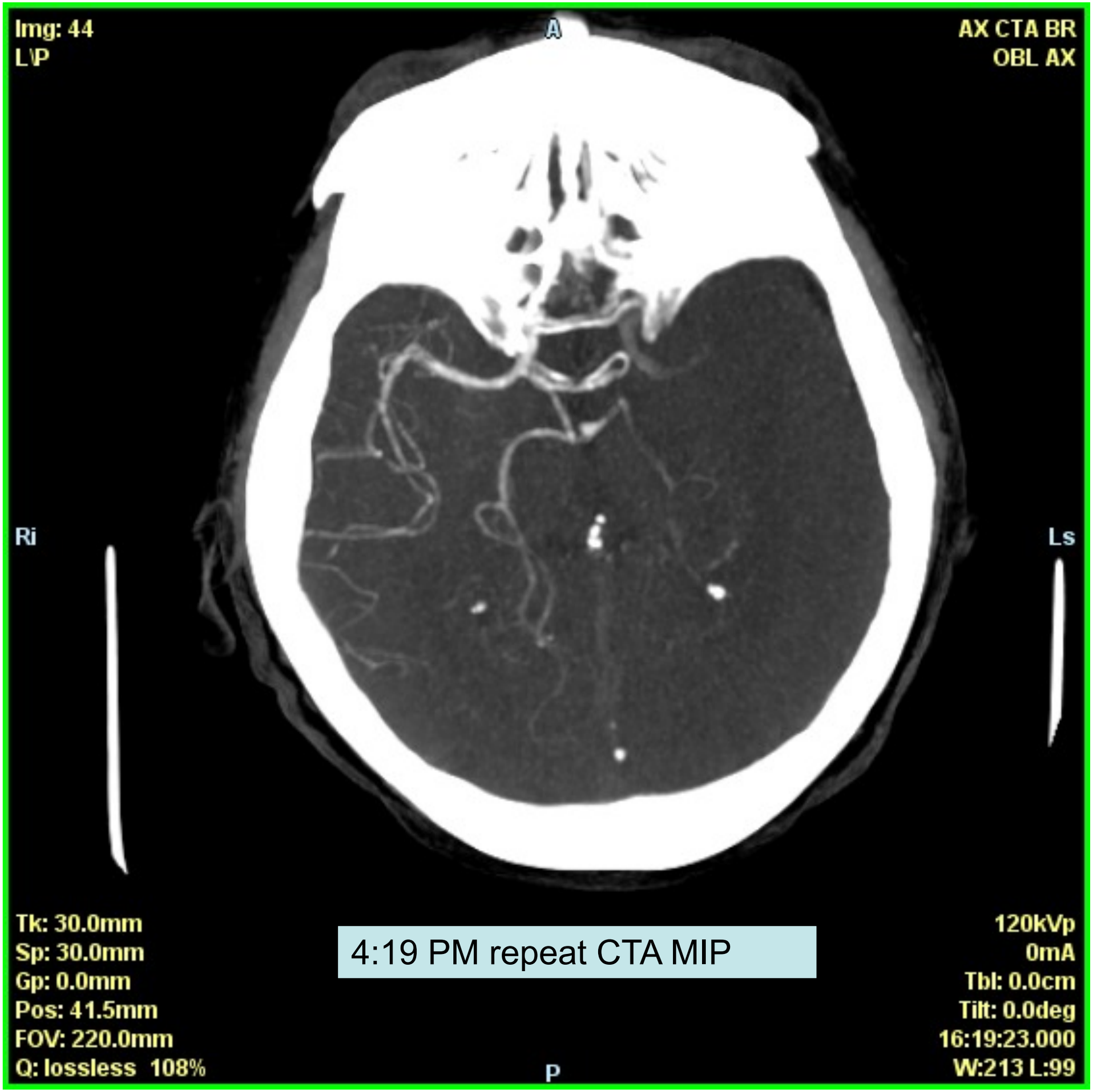


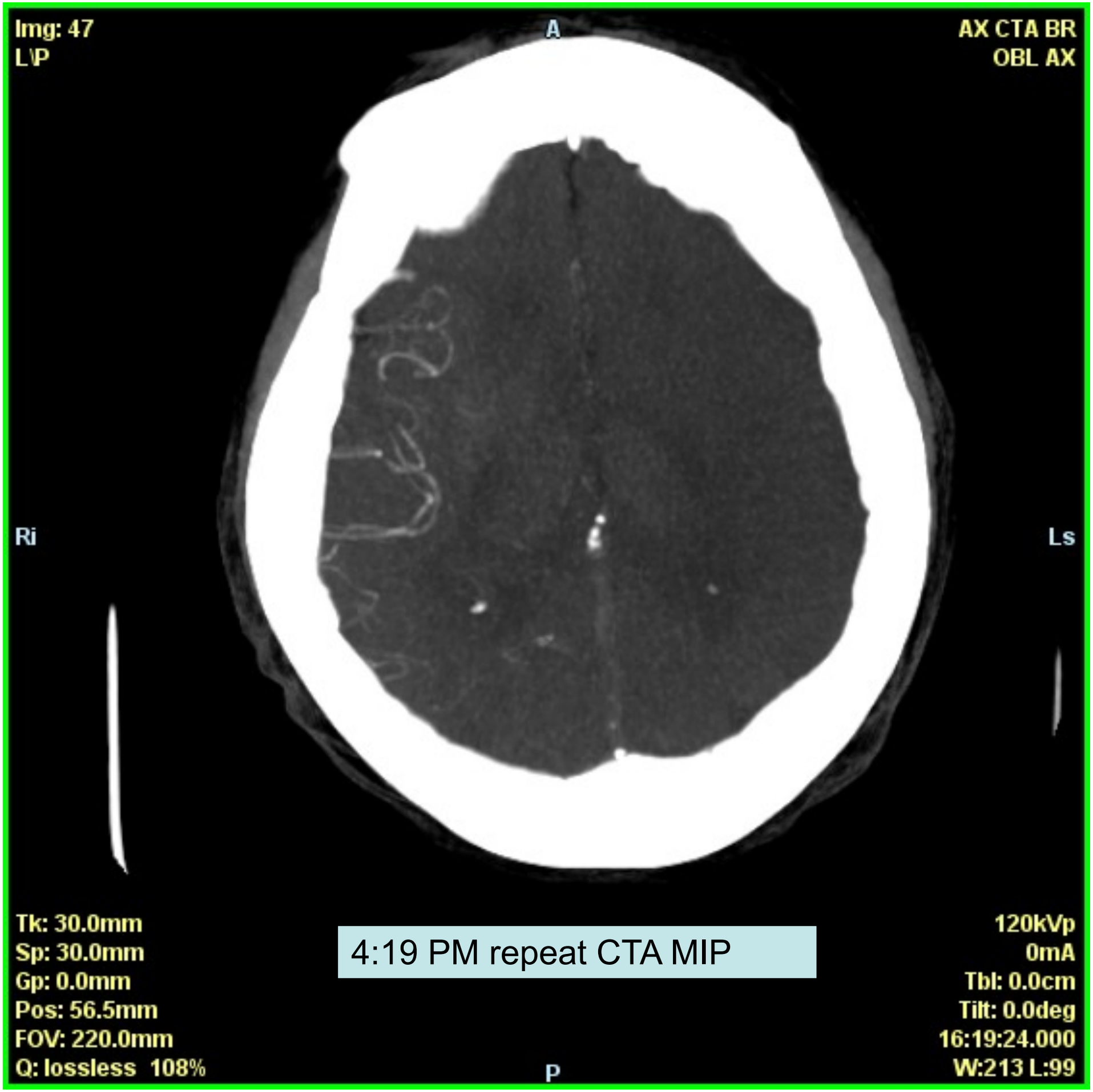
4:14 PM repeat CT Head




Img: 16
L\P
As
5MM NON-ENHANCED BRAIN
OBL AX
4:14 PM repeat CT Head
R
L
Tk: 5.0mm
Sp: 20.9mm
Gp: -15.9mm
Pos: 50.2mm
FOV: 250.0mm
Q: lossless 108%
Pi
120kVp
205mA
Tbl: 187.0cm
Tilt: 17.0deg
16:14:51.000
W:49 L:29


Img: 43
L\P
A
AX CTA BR
OBL AX
Ri
Ls
Tk: 30.0mm
Sp: 30.0mm
Gp: 0.0mm
Pos: 36.5mm
FOV: 220.0mm
Q: lossless 108%
4:19 PM repeat CTA MIP
P
120kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:19:22.000
W:213 L:99


Img: 44
L\P
A
AX CTA BR
OBL AX
Ri
Ls
Tk: 30.0mm
Sp: 30.0mm
Gp: 0.0mm
Pos: 41.5mm
FOV: 220.0mm
Q: lossless 108%
4:19 PM repeat CTA MIP
P
120kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:19:23.000
W:213 L:99


Img: 47
L\P
A
AX CTA BR
OBL AX
Ri
Ls
Tk: 30.0mm
Sp: 30.0mm
Gp: 0.0mm
Pos: 56.5mm
FOV: 220.0mm
Q: lossless 108%
4:19 PM repeat CTA MIP
P
120kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:19:24.000
W:213 L:99

Img: 1
Unk

SCREENSAVE
UNK

Final Settings

Click on parameters' names to modify them.

Registration	yes
Threshold	Air 0 Bone 120
Artery	ROI 1
Vein	ROI 2
Last pre-enhancement	3
First post-enhancement	17

Film/ Save

Save/ State

Advanced Settings

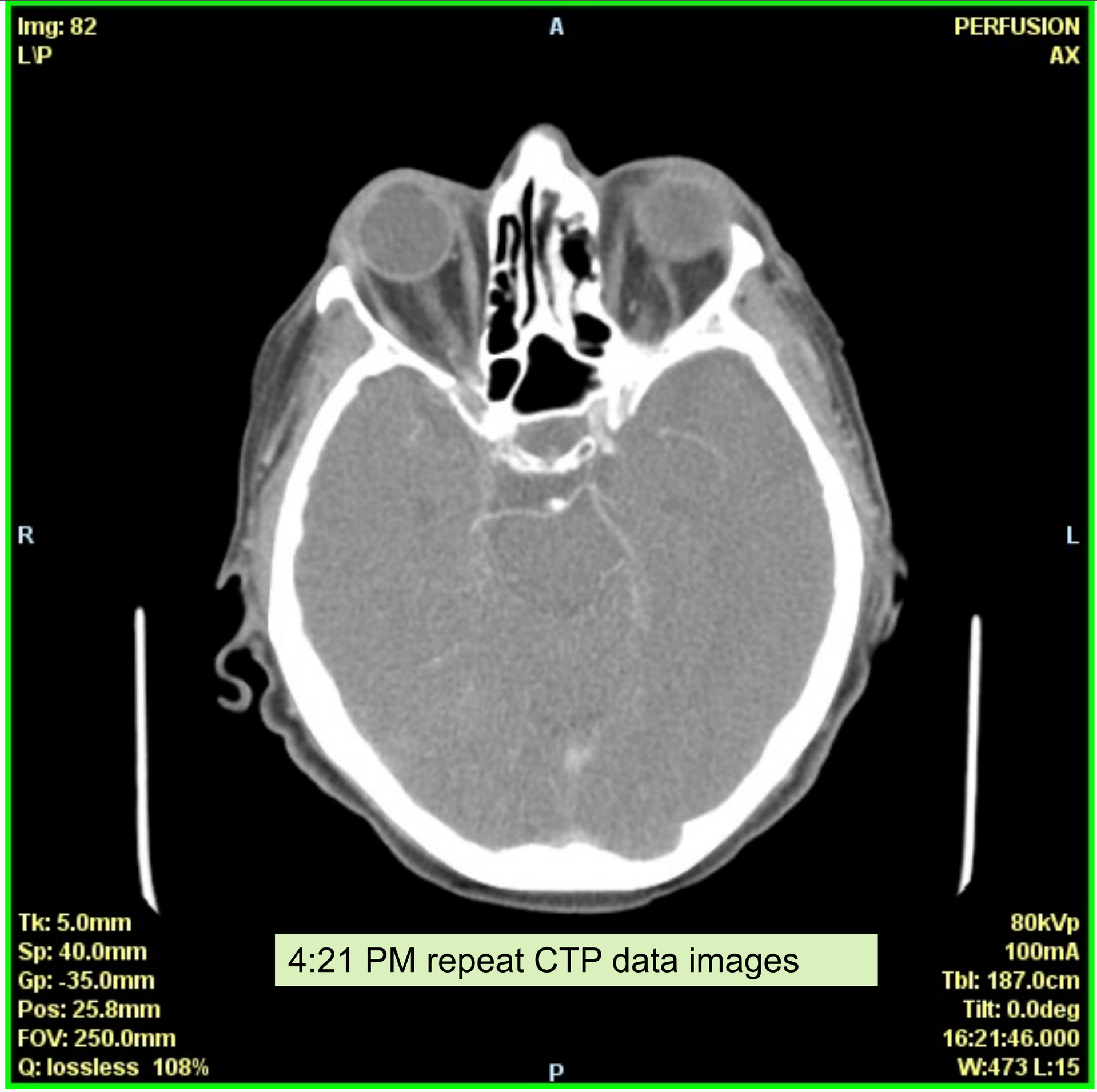
Compute

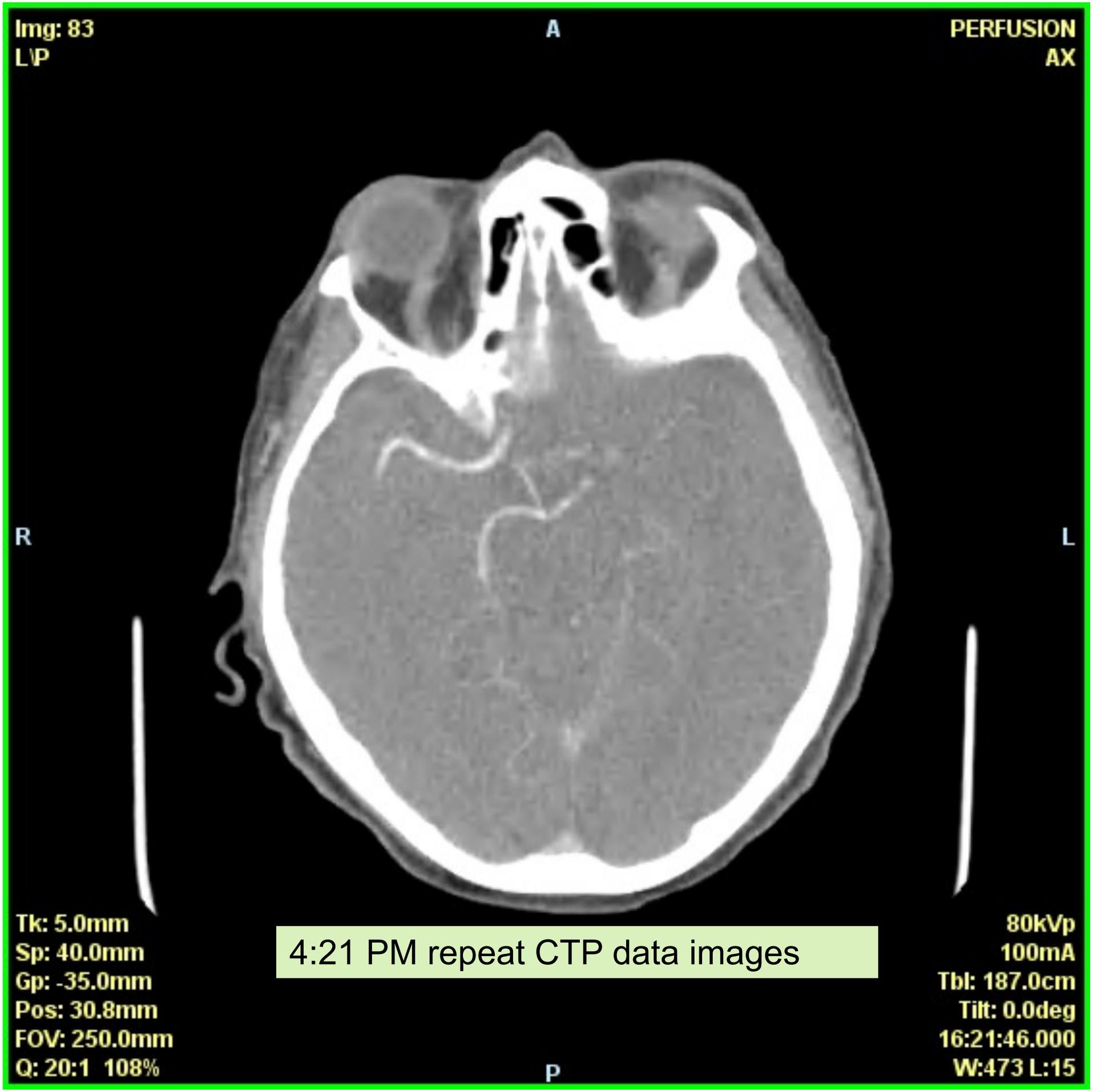
Close

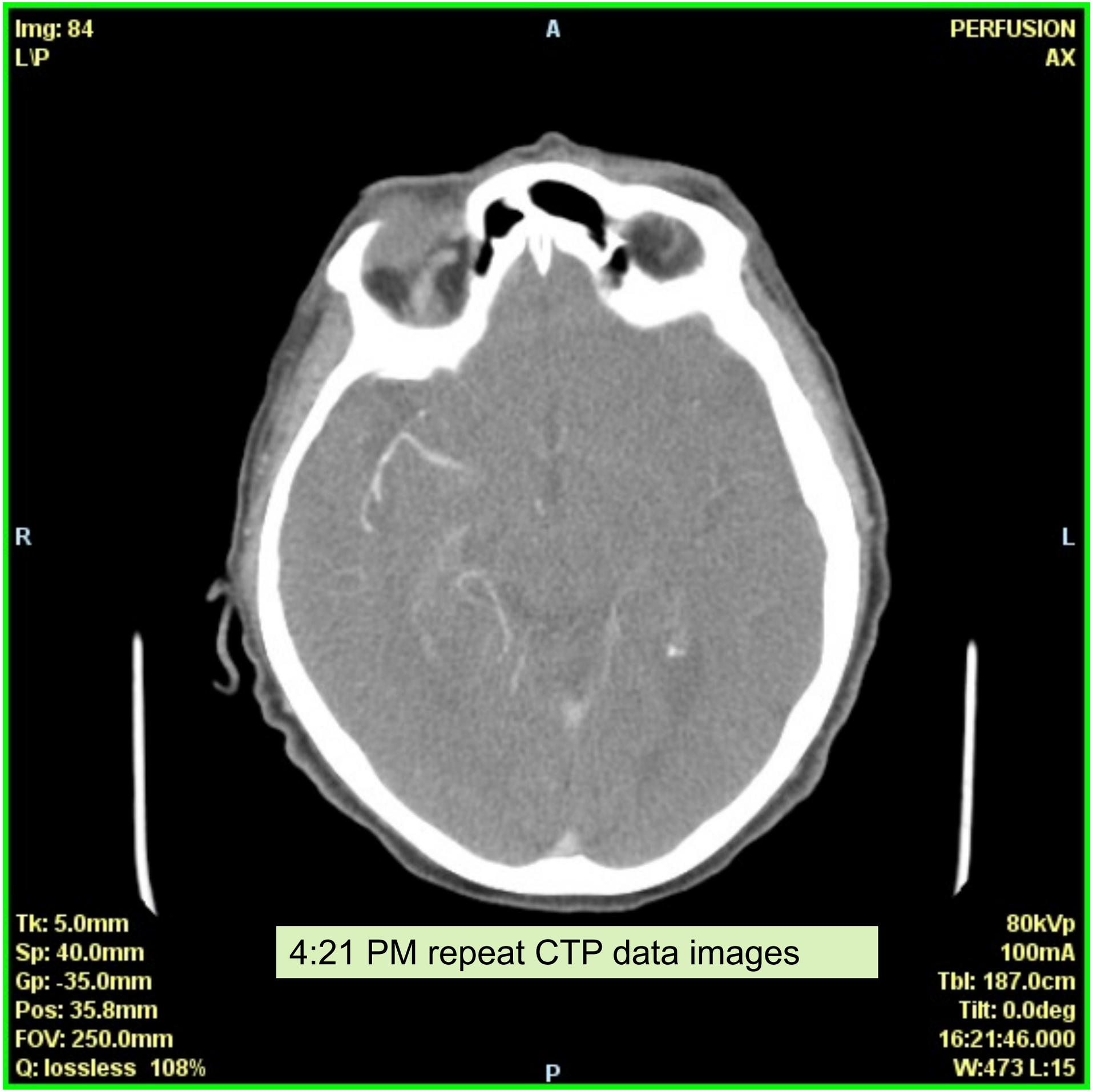
Next Protocol

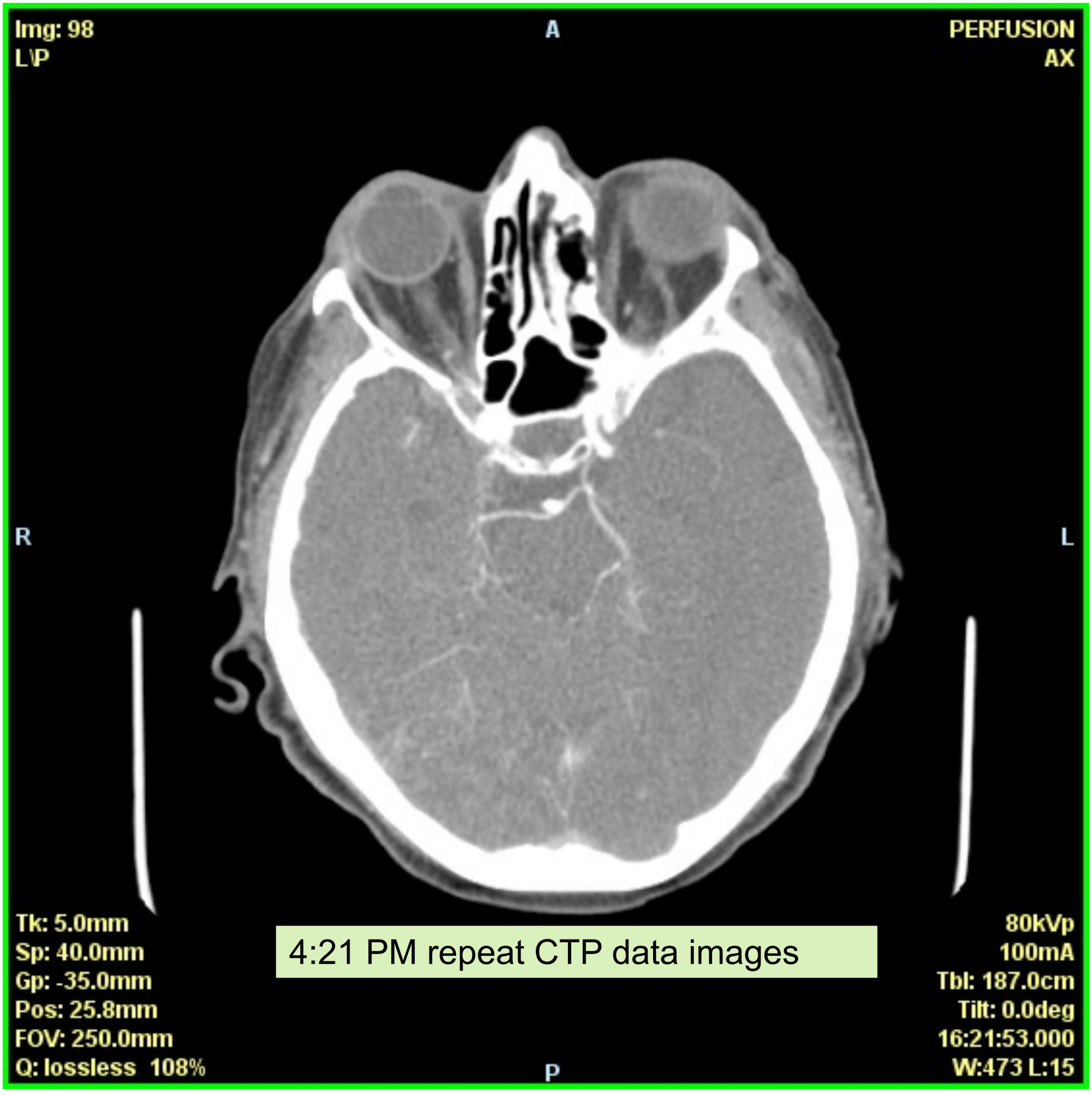
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%

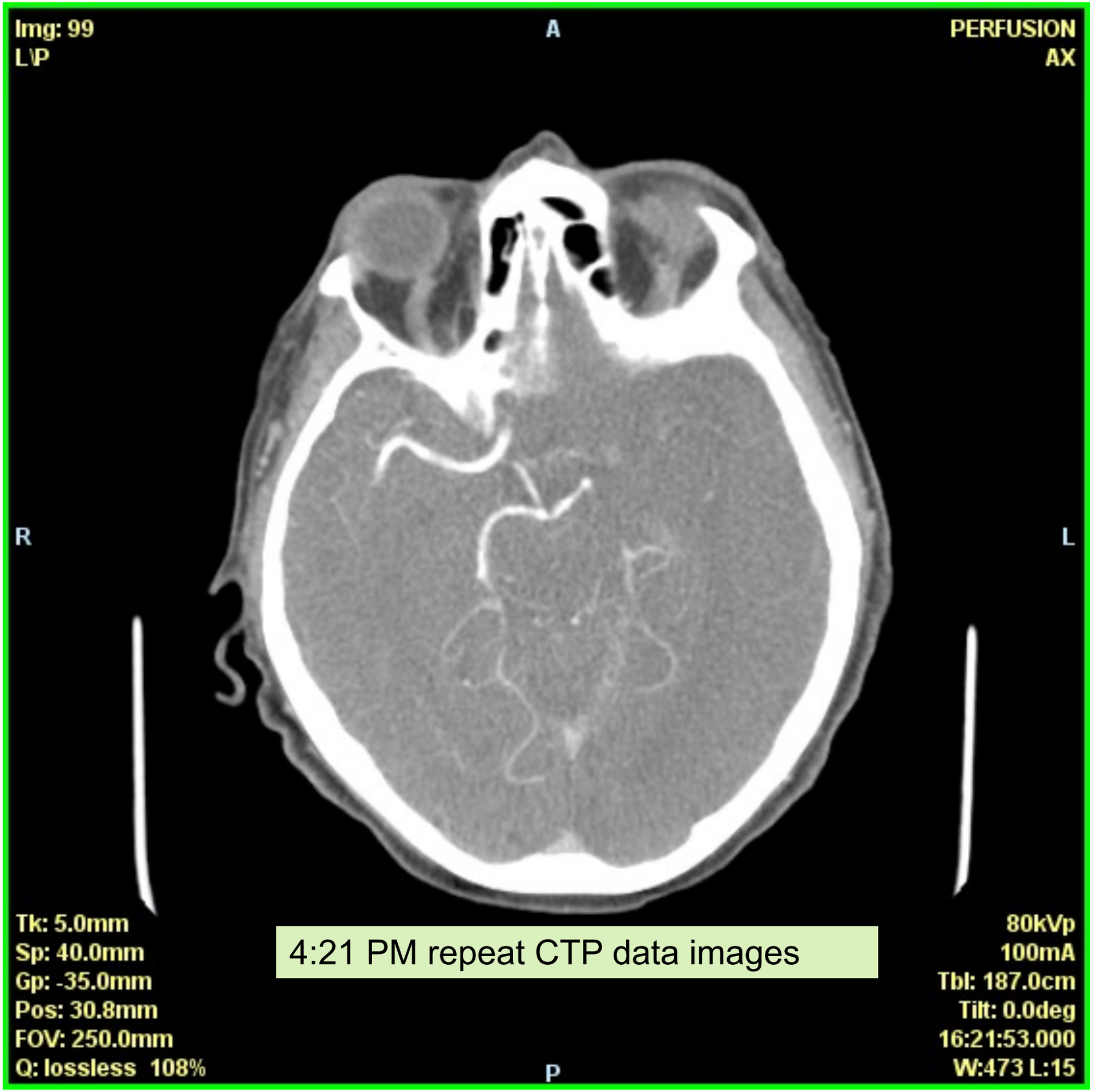
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

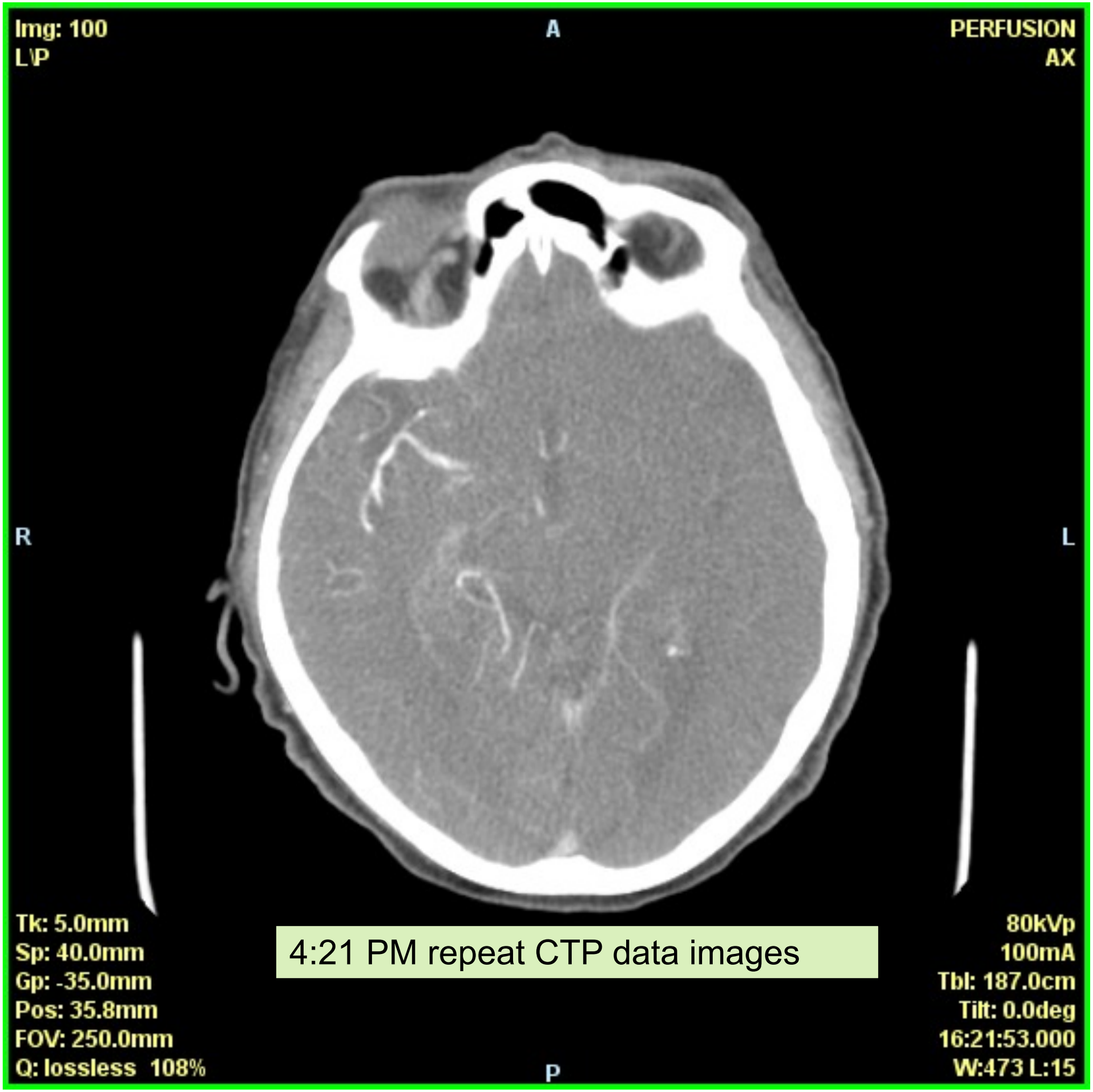

Img: 82
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 25.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:21:46.000
W:473 L:15
P

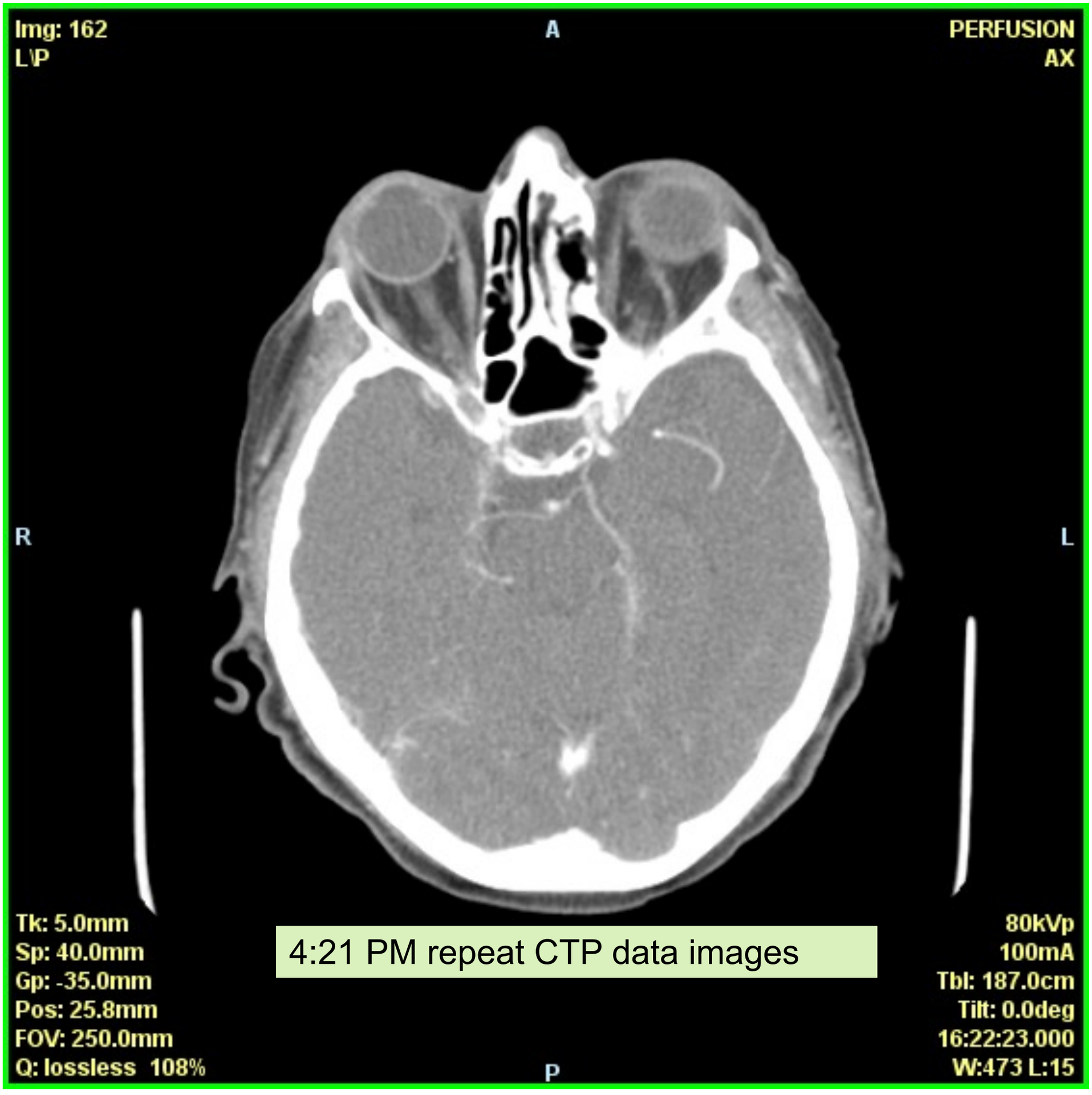

Img: 83
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 30.8mm
FOV: 250.0mm
Q: 20:1 108%
4:21 PM repeat CTP data images
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:21:46.000
W:473 L:15
P

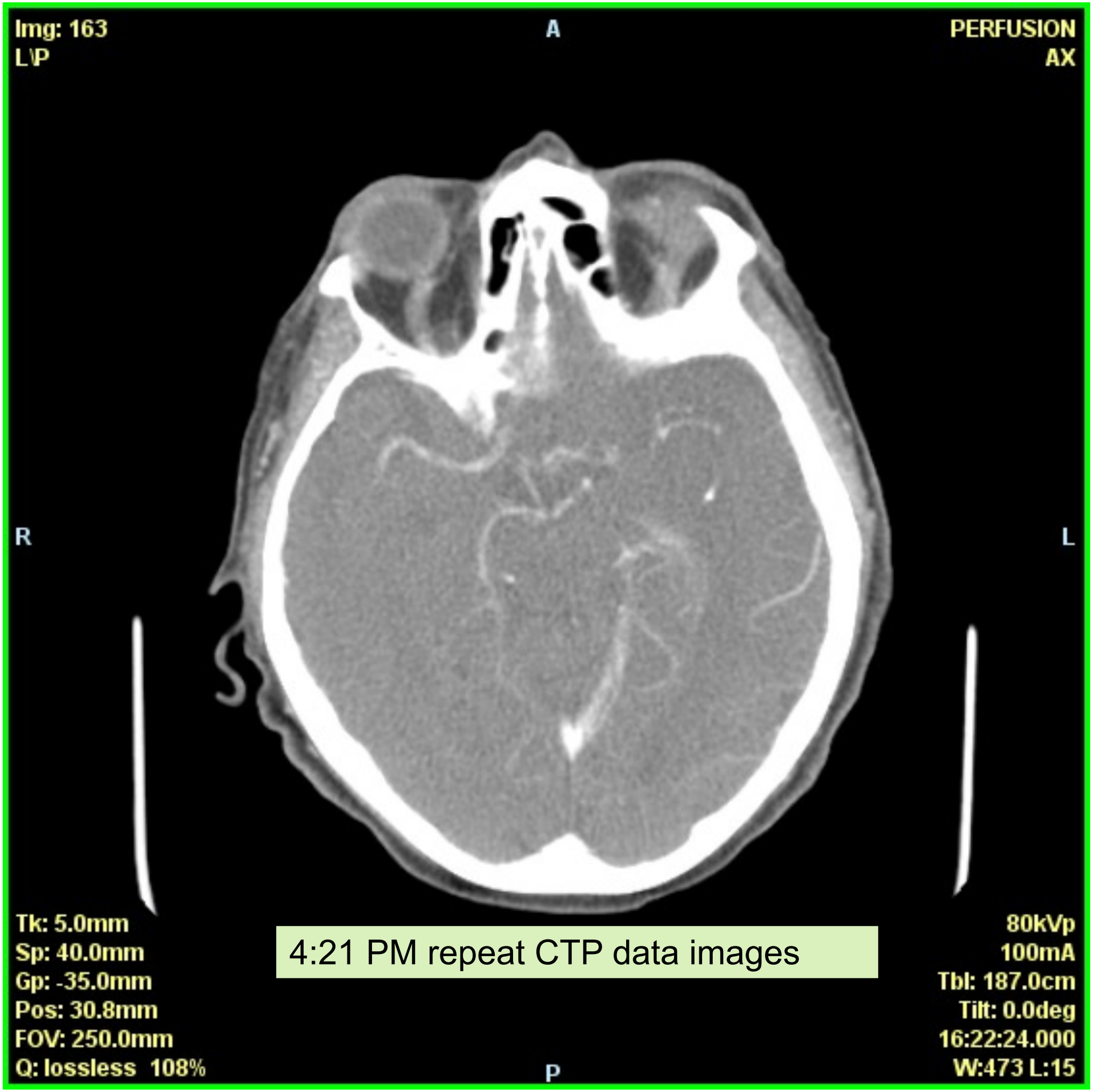

Img: 84
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 35.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
P
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:21:46.000
W:473 L:15


Img: 98
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 25.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:21:53.000
W:473 L:15
P


Img: 99
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 30.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
P
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:21:53.000
W:473 L:15


Img: 100
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 35.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
P
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:21:53.000
W:473 L:15


Img: 162
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 25.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:22:23.000
W:473 L:15
P


Img: 163
L\P
A
PERFUSION
AX
R
L
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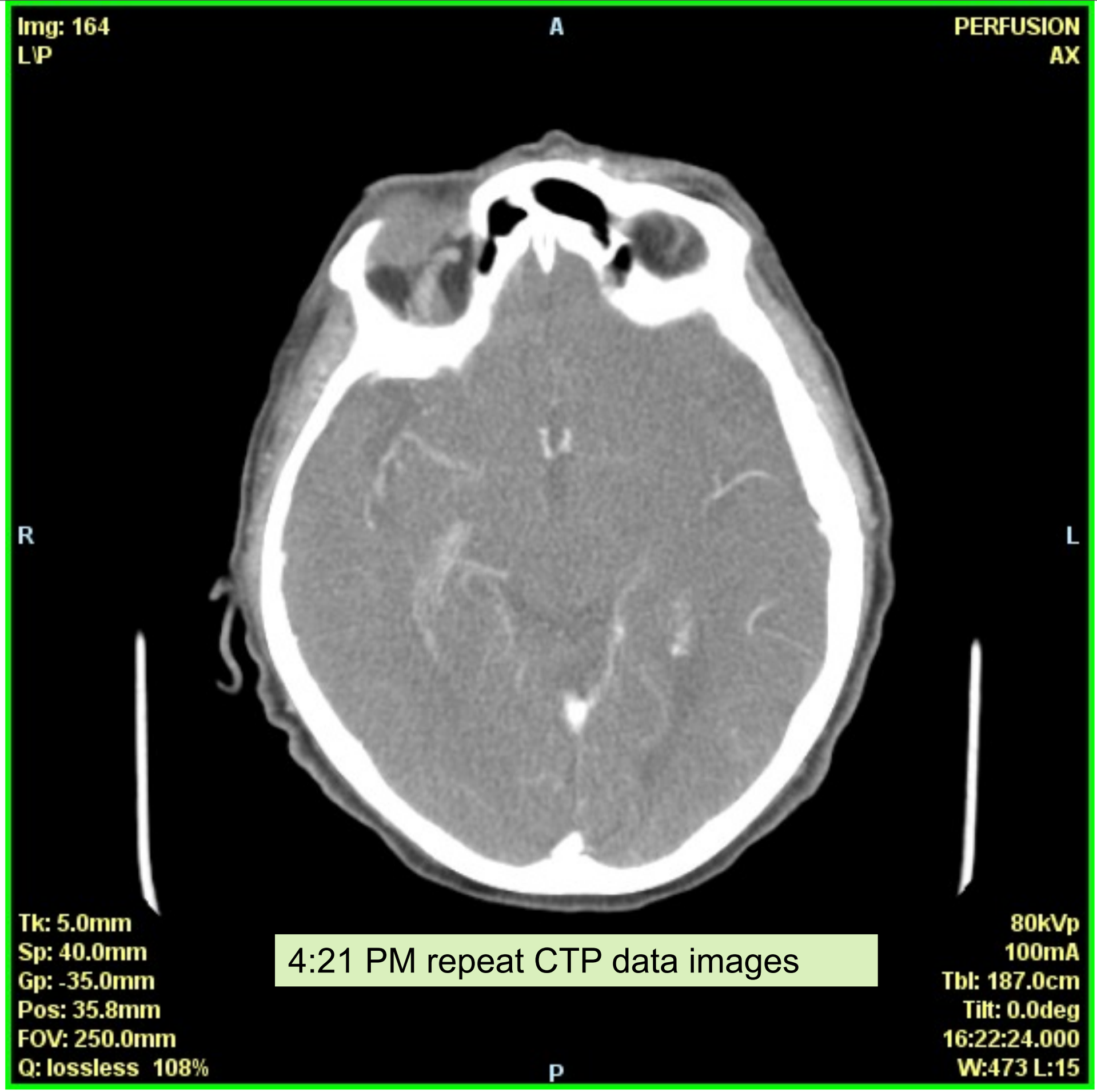
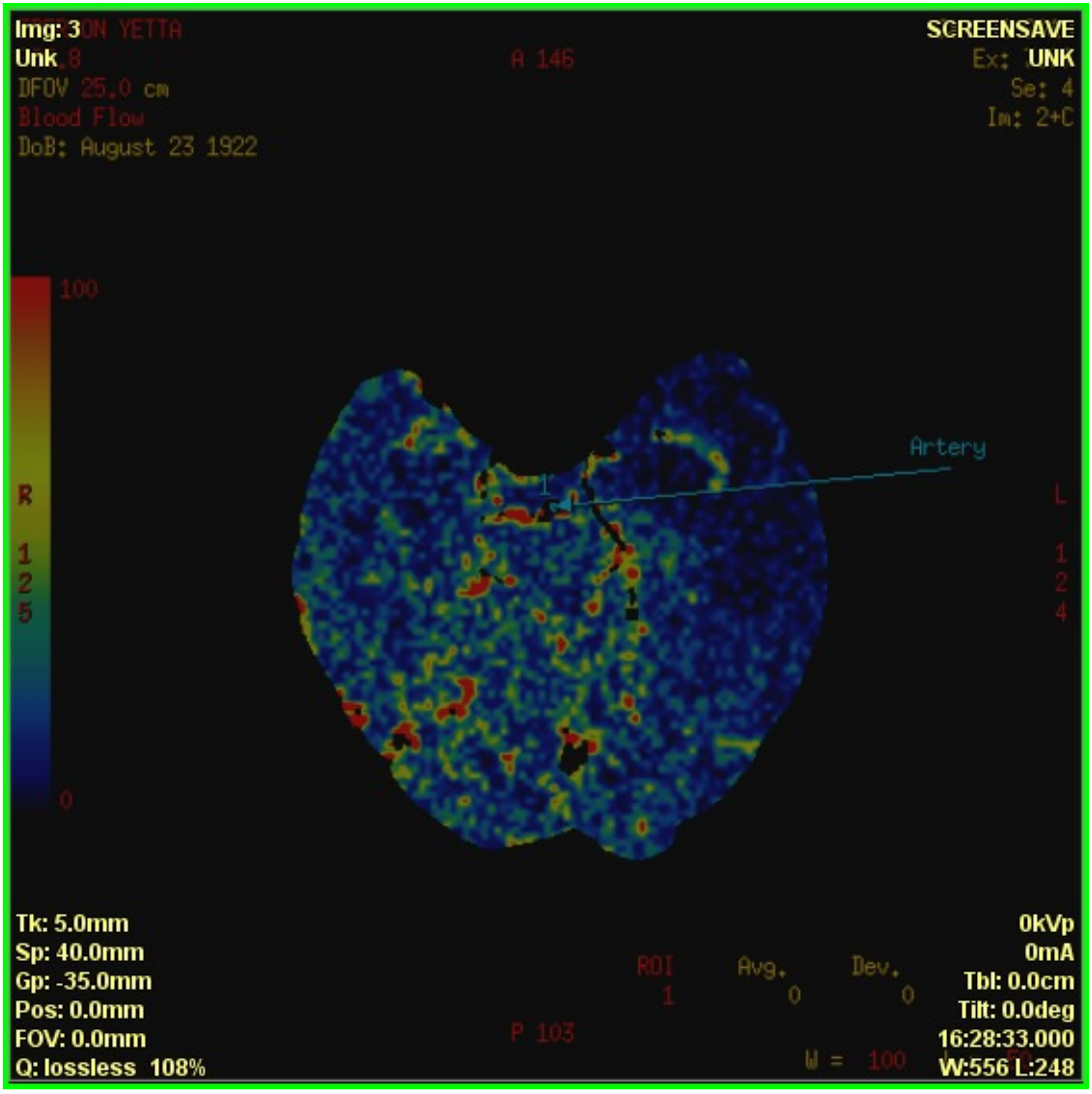
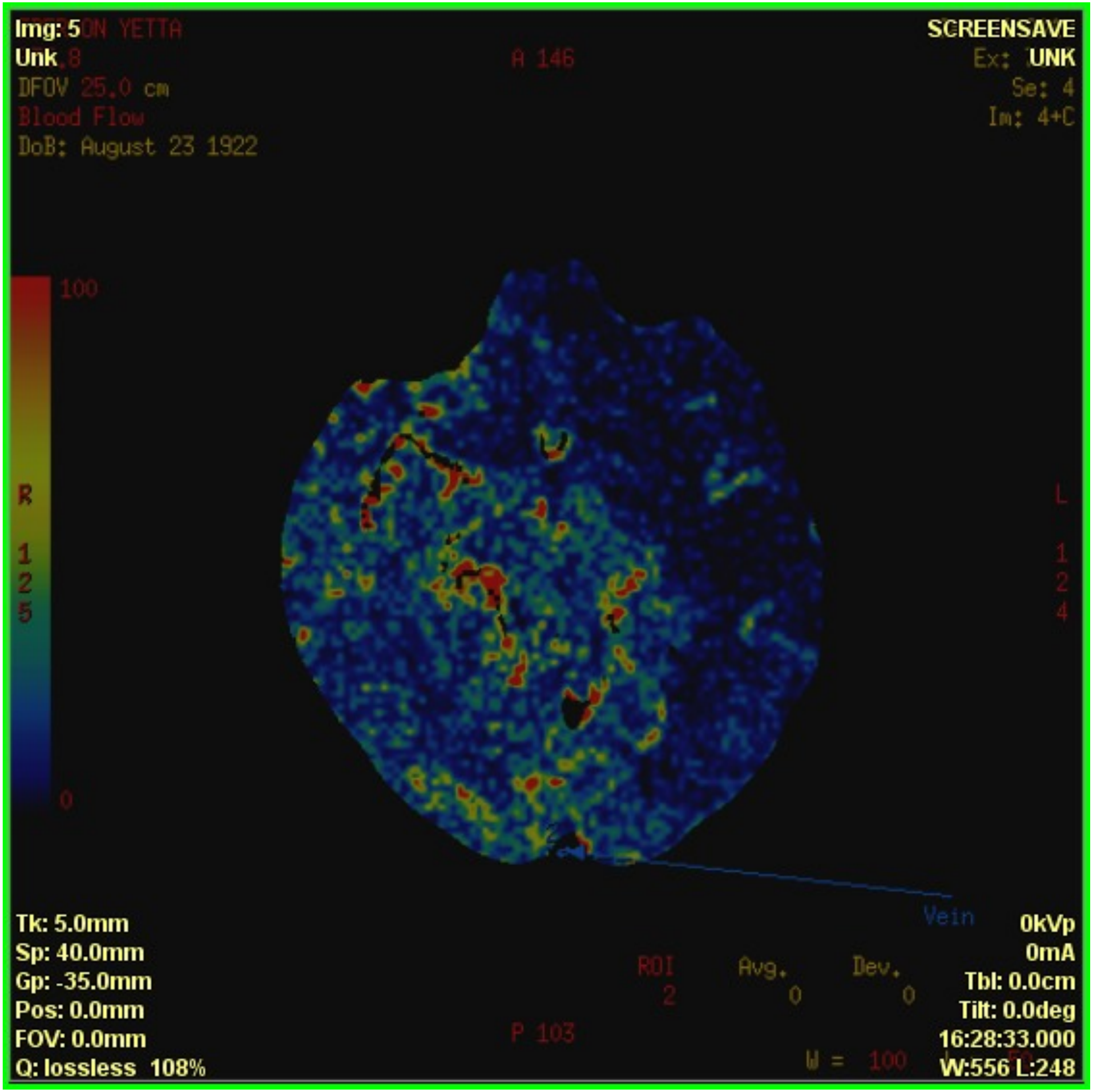
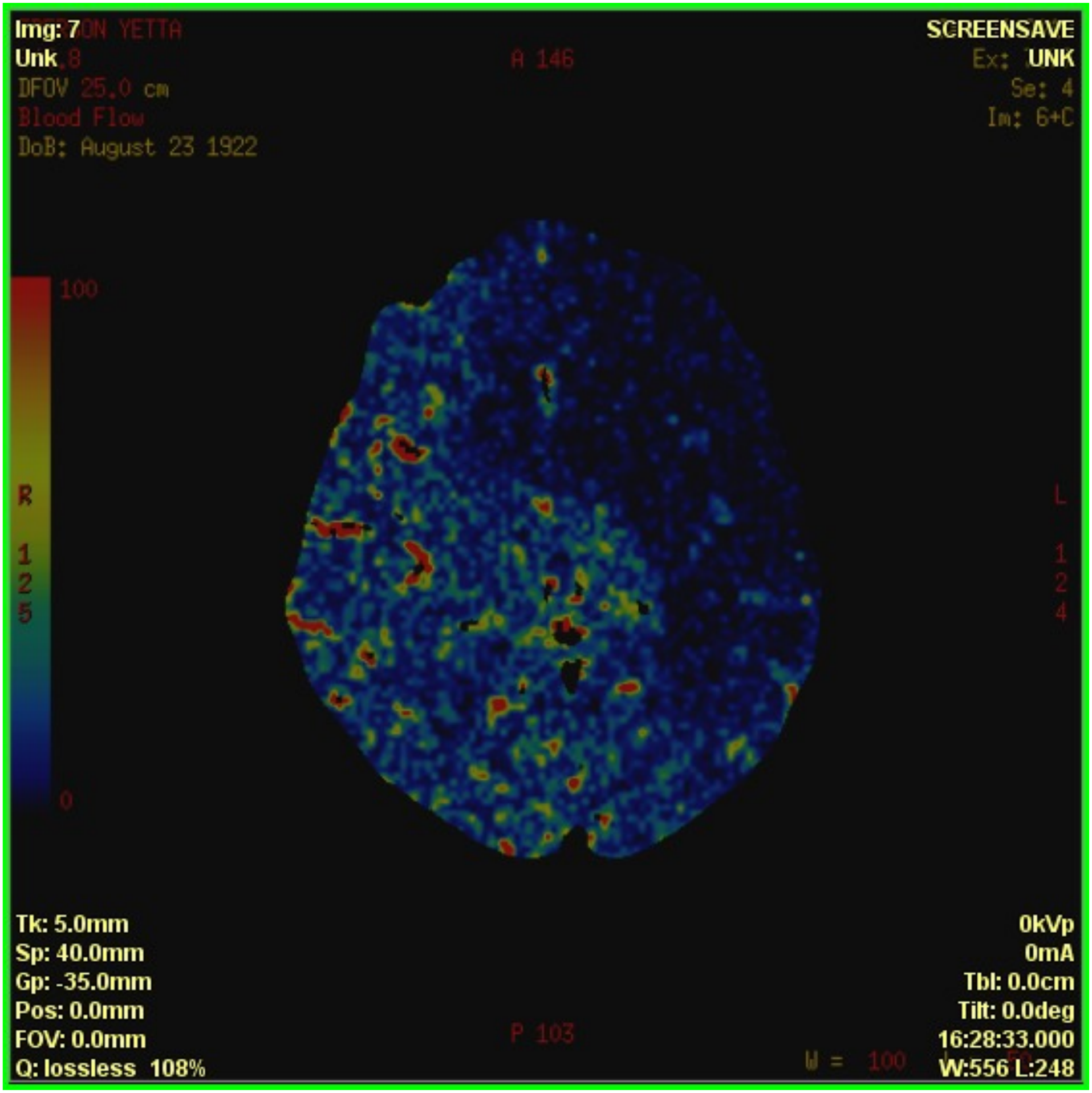
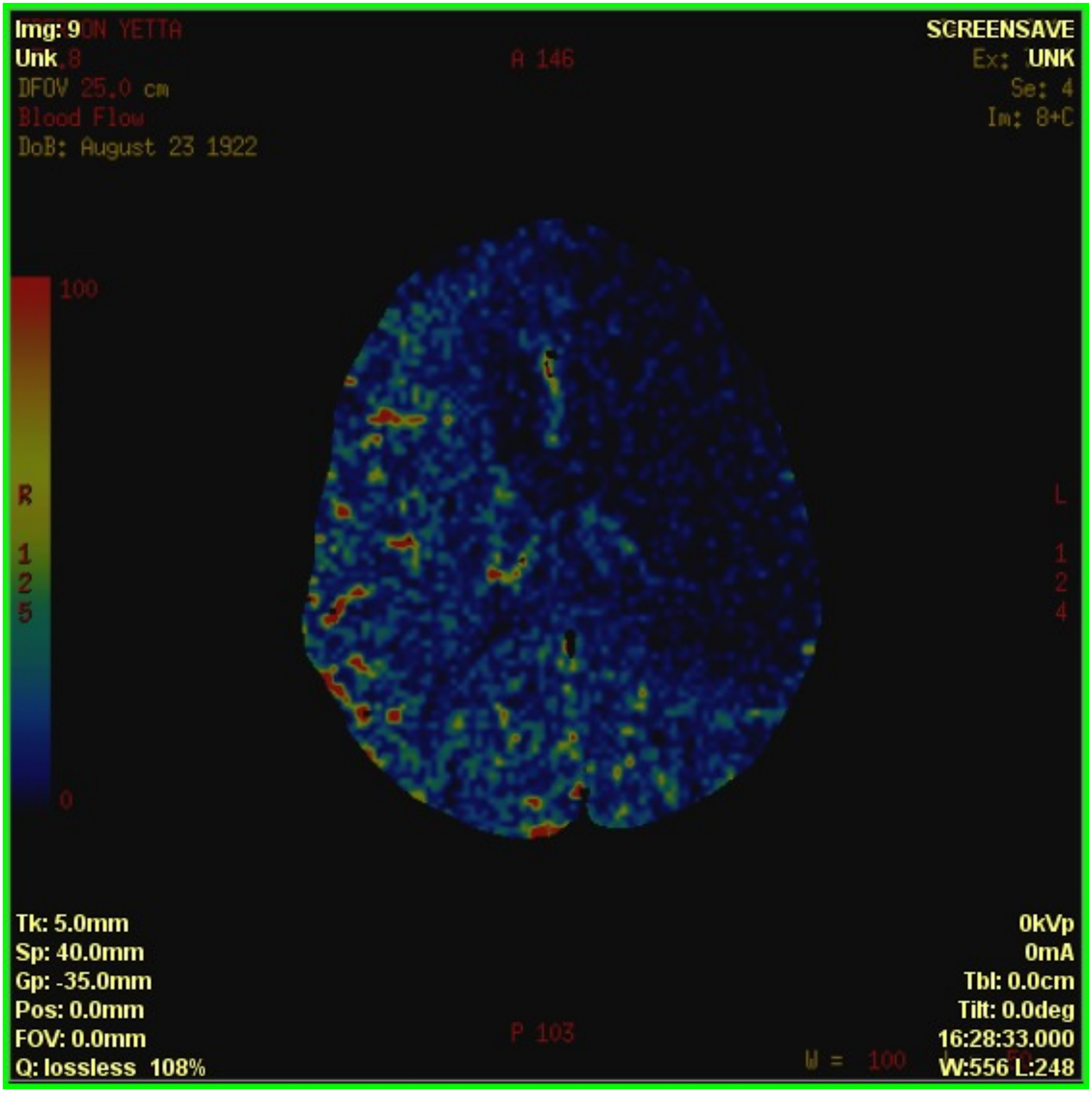
Sp: 40.0mm
Gp: -35.0mm
Pos: 30.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
P
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:22:24.000
W:473 L:15

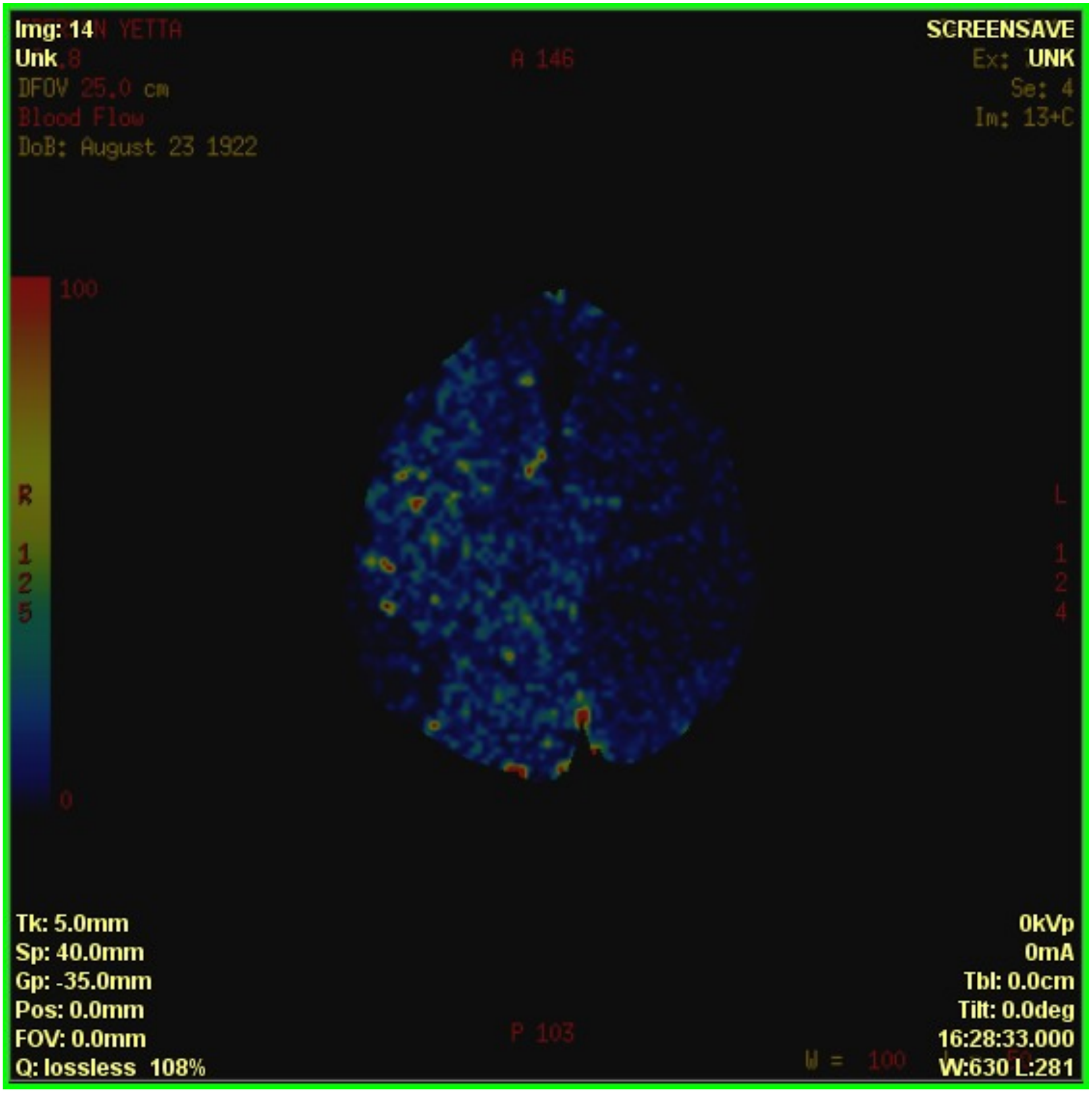

Img: 164
L\P
A
PERFUSION
AX
R
L
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 35.8mm
FOV: 250.0mm
Q: lossless 108%
4:21 PM repeat CTP data images
P
80kVp
100mA
Tbl: 187.0cm
Tilt: 0.0deg
16:22:24.000
W:473 L:15

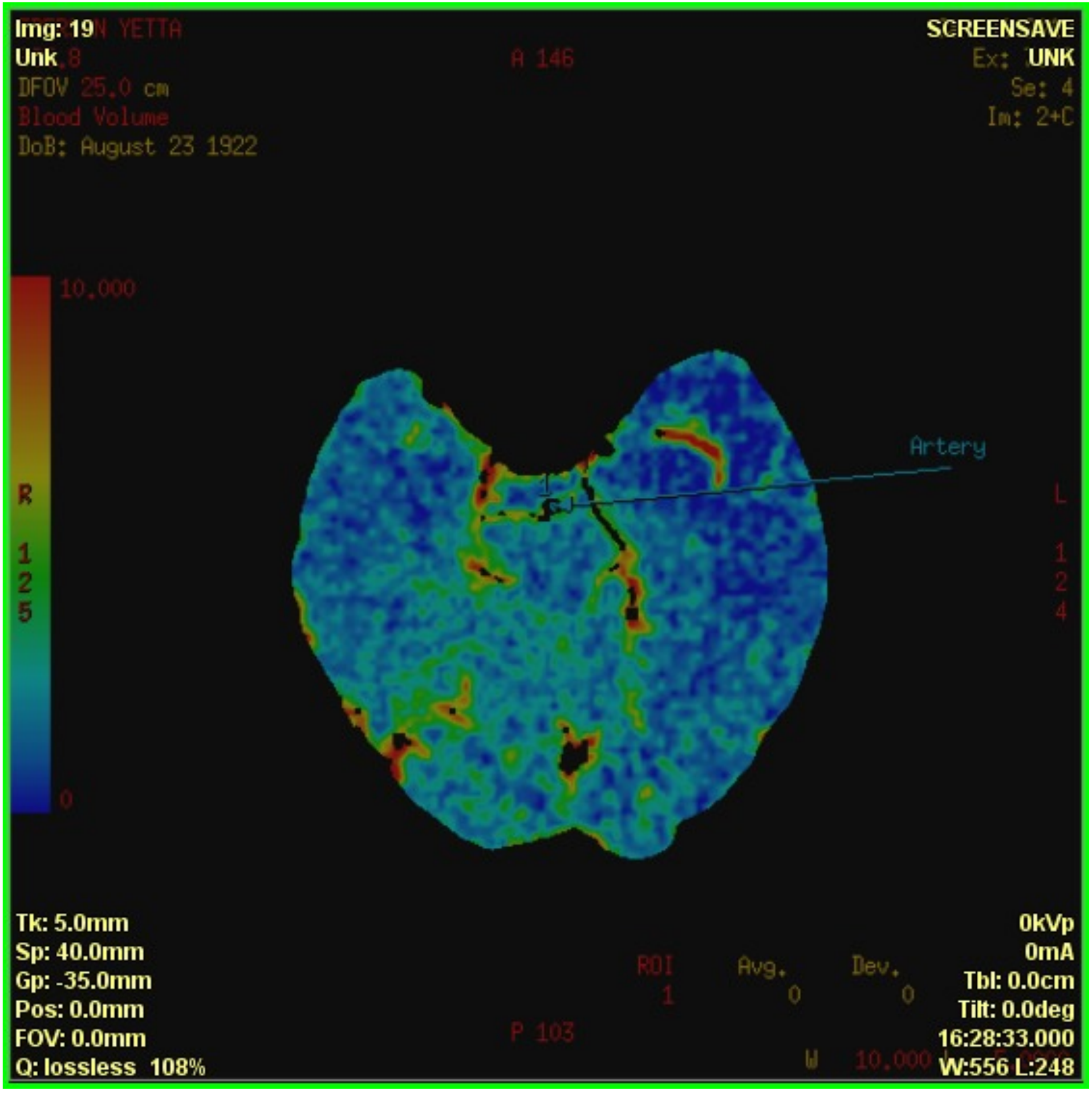

Img: 3ON YETTA
Unk,8
DFOV 25.0 cm
Blood Flow
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 2+C
100
R
1
2
5
0
Artery
1
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI
1
Avg.
0
Dev.
0
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

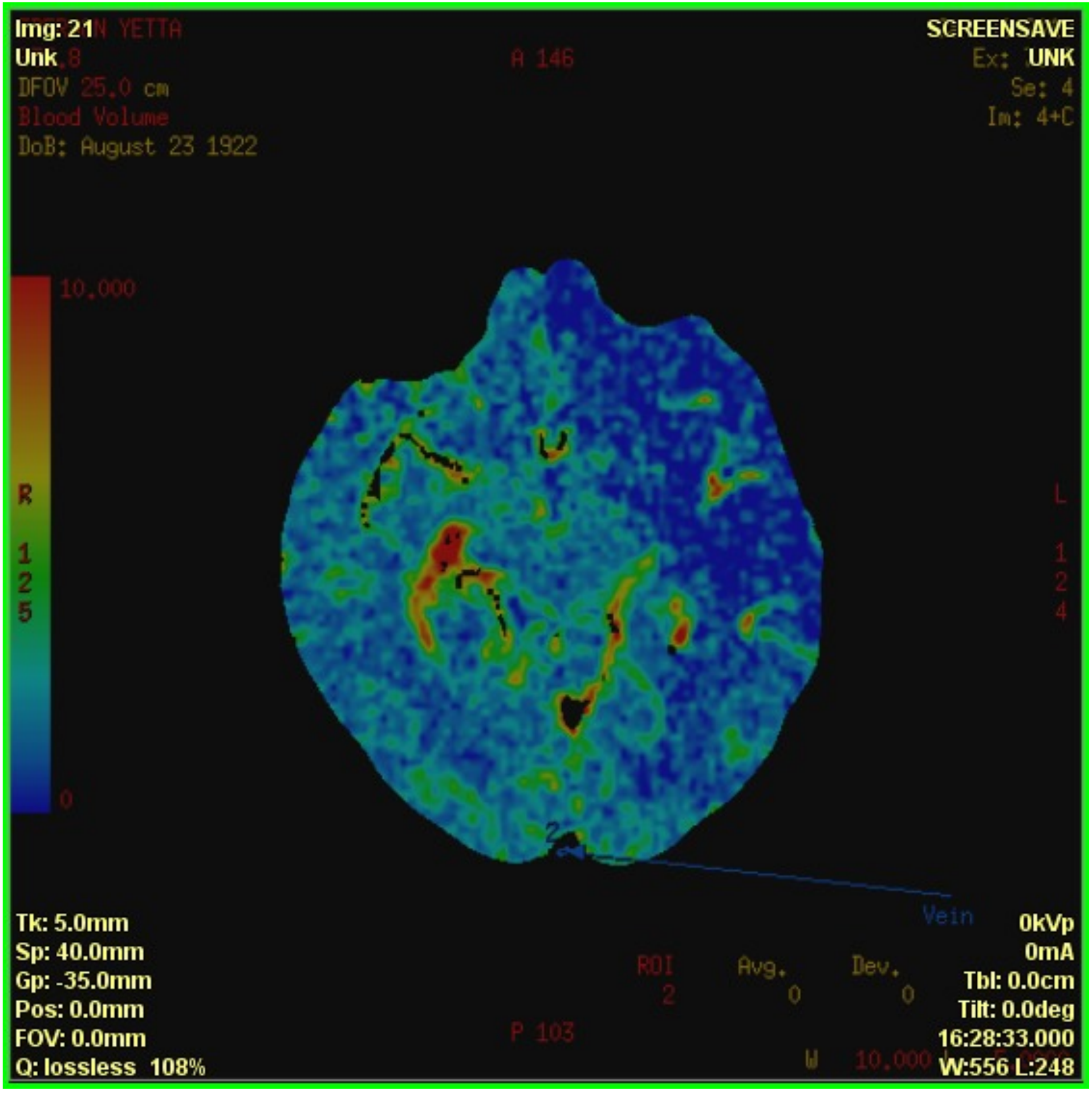

Img: 5ON YETTA
Unk,8
DFOV 25.0 cm
Blood Flow
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 4+C
100
R
1
2
5
0
L
1
2
4
Vein
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI
2
Avg.
0
Dev.
0
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

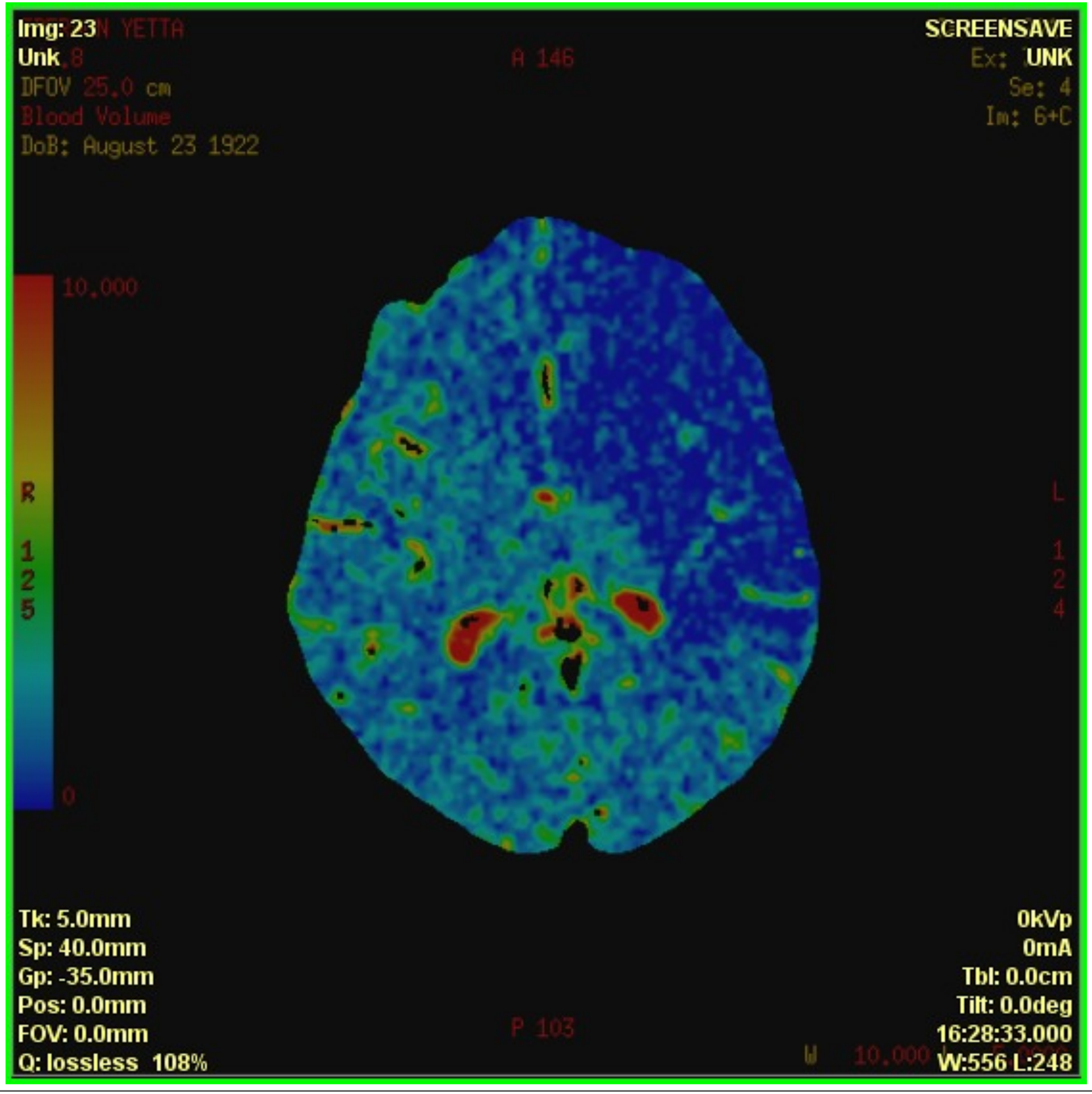

Img: 7ON YETTA
Unk,8
DFOV 25.0 cm
Blood Flow
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 6+C
100
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

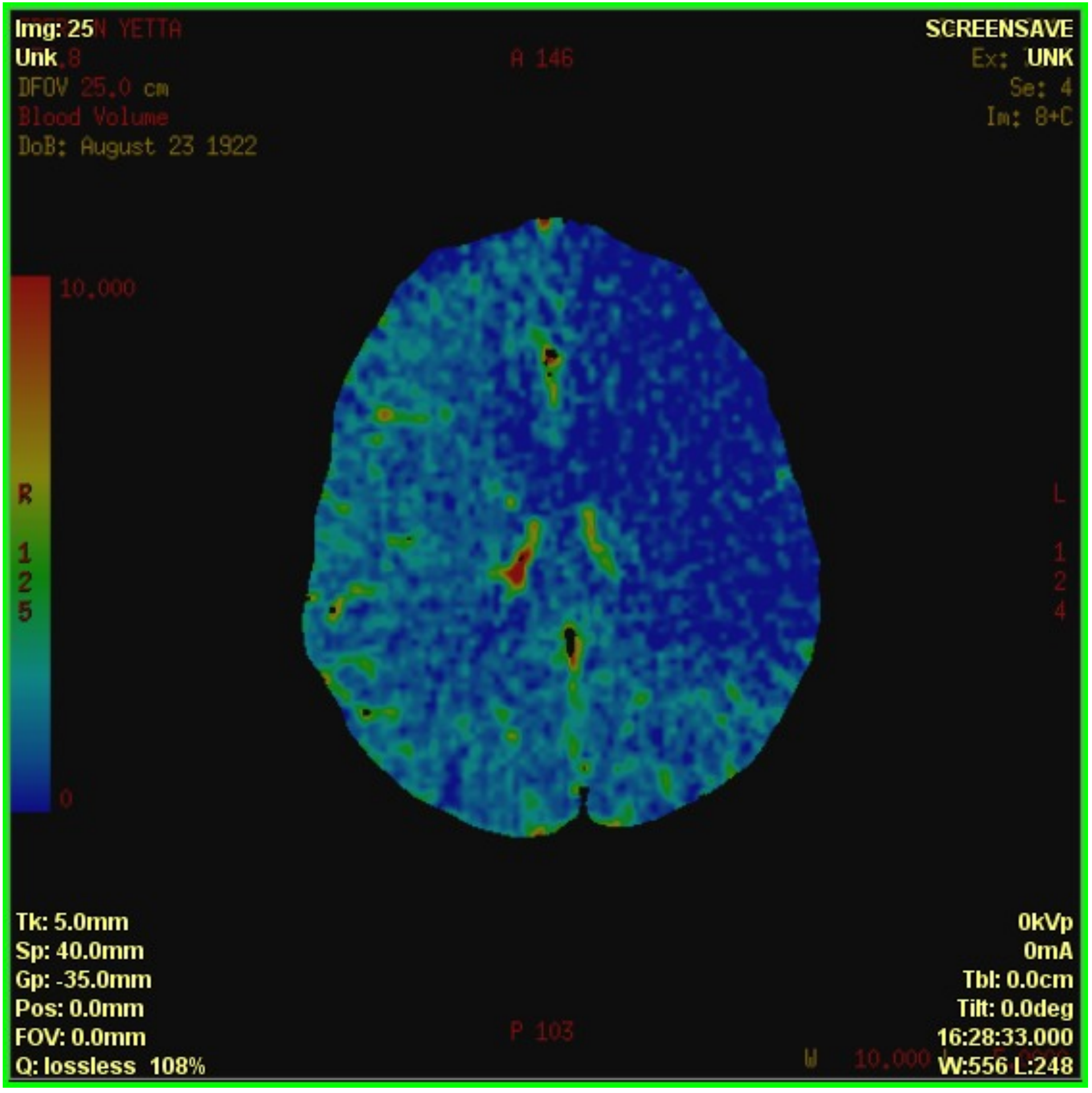

Img: 9ON YETTA
Unk,8
DFOV 25.0 cm
Blood Flow
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 8+C
100
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

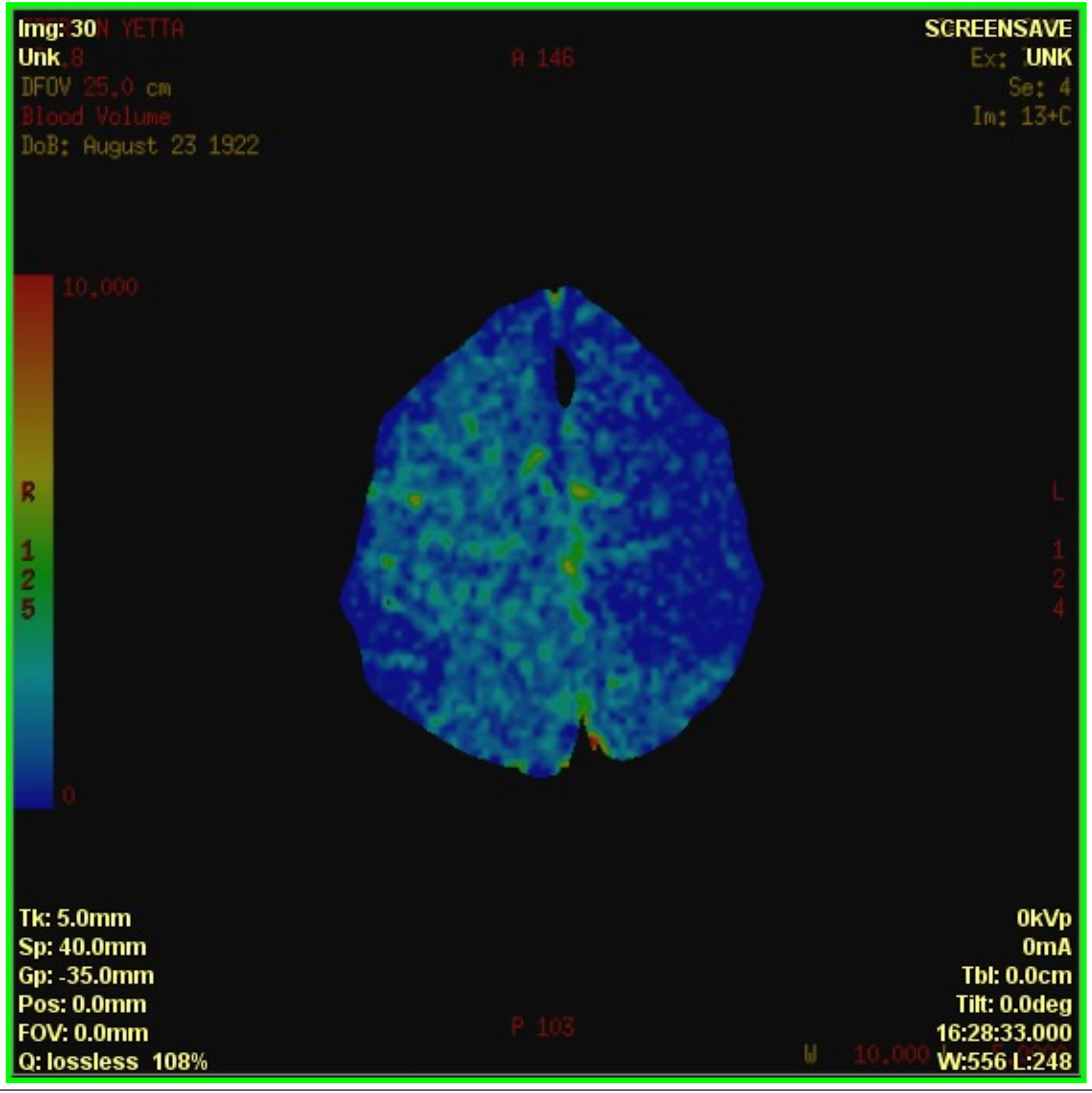

Img: 14
Unk.8
DFOV 25.0 cm
Blood Flow
DoB: August 23 1922
SCREENSAVE
Ex: UNK
Se: 4
Im: 13+C
100
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:630 L:281

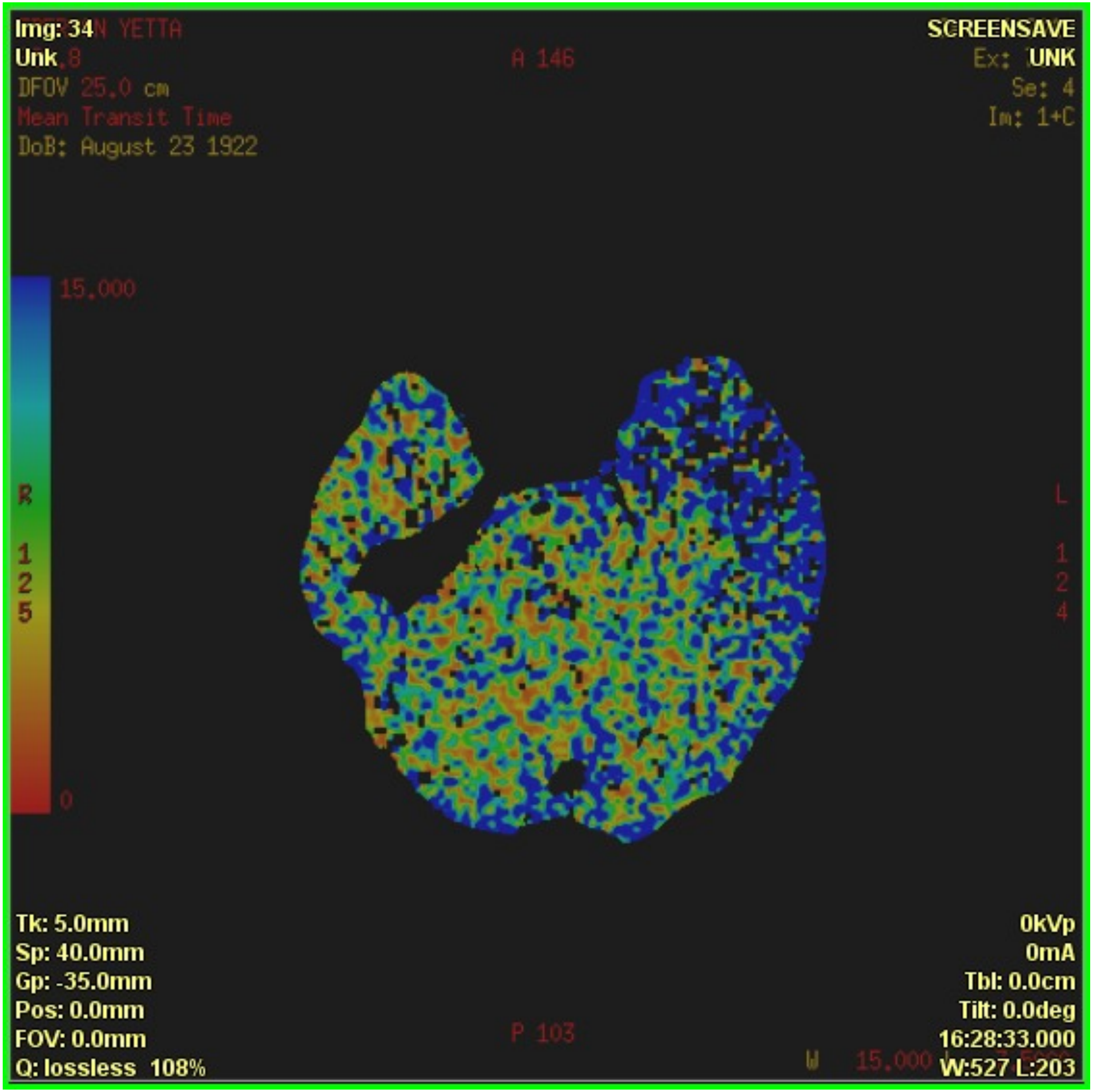

Img: 19N YETTA
Unk,8
DFOV 25.0 cm
Blood Volume
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 2+C
10.000
R
1
2
5
0
Artery
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI Avg. Dev.
1 0 0
P 103
W 10.000
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

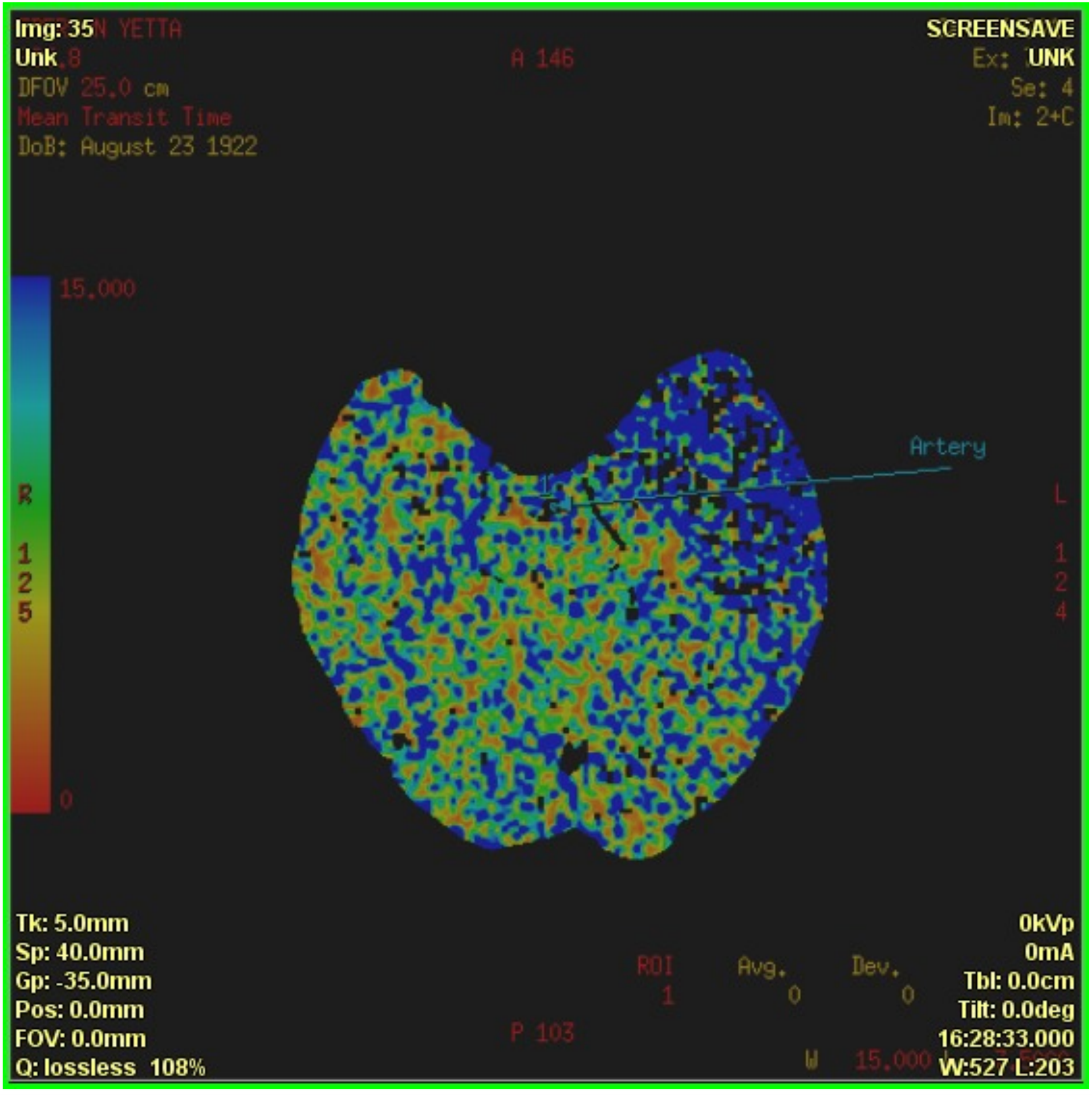

Img: 21N YETTA
Unk,8
DFOV 25.0 cm
Blood Volume
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 4+C
10.000
R
1
2
5
0
L
1
2
4
2
Vein
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI
2
Avg.
0
Dev.
0
P 103
W 10.000
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

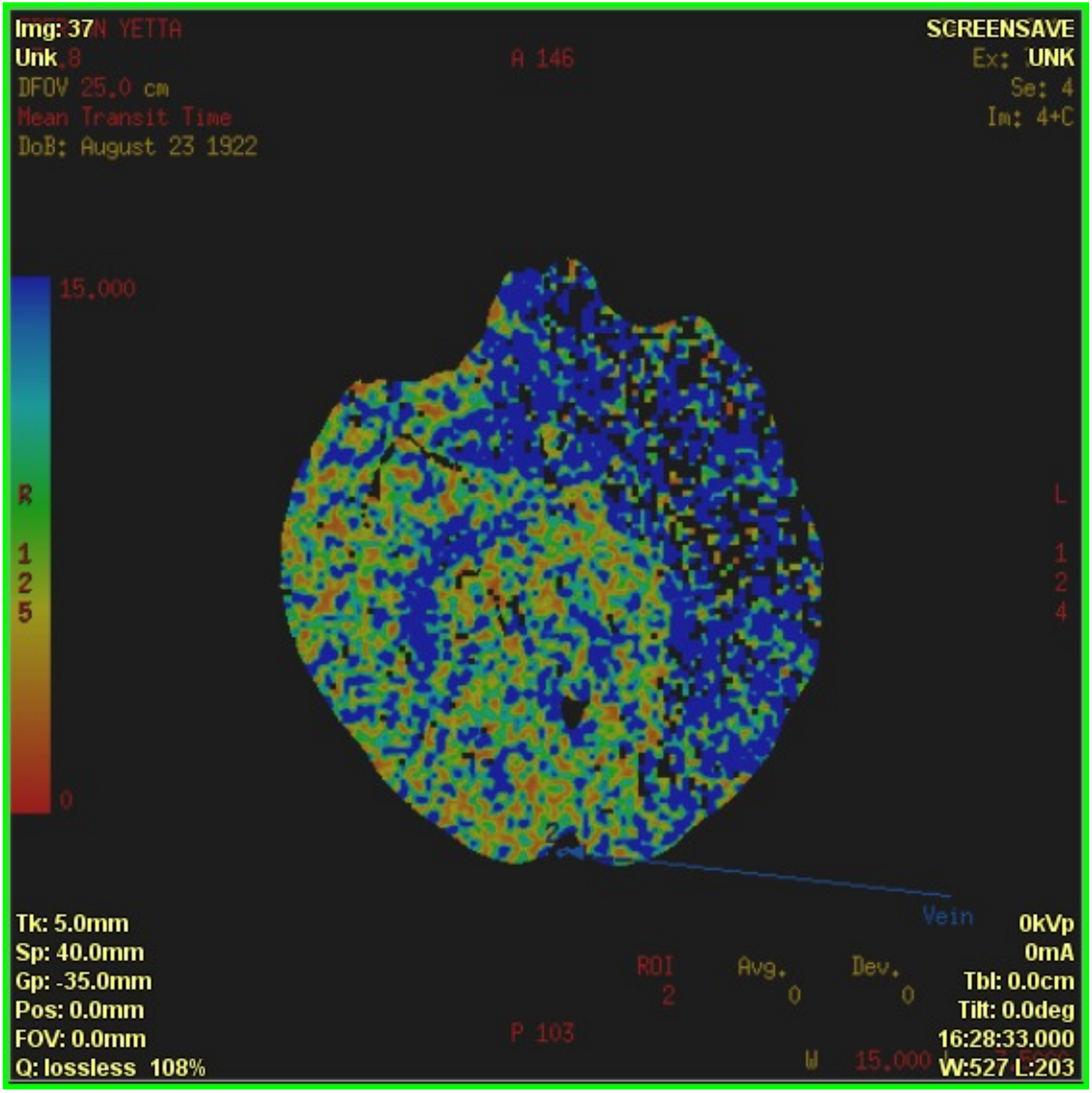

Img: 23N YETTA
Unk,8
DFOV 25.0 cm
Blood Volume
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 6+C
10.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

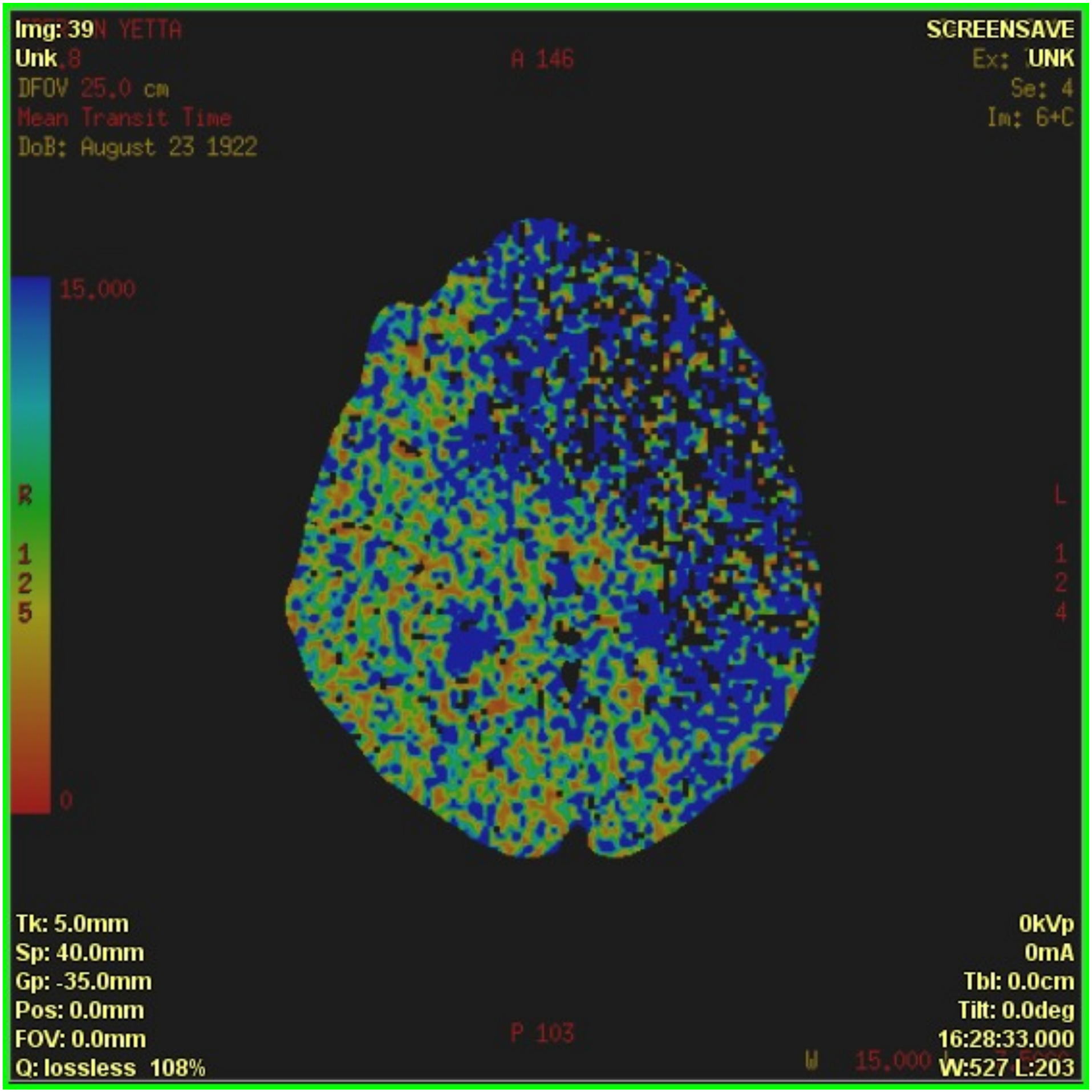

Img: 25N YETTA
Unk,8
DFOV 25.0 cm
Blood Volume
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 8+C
10.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

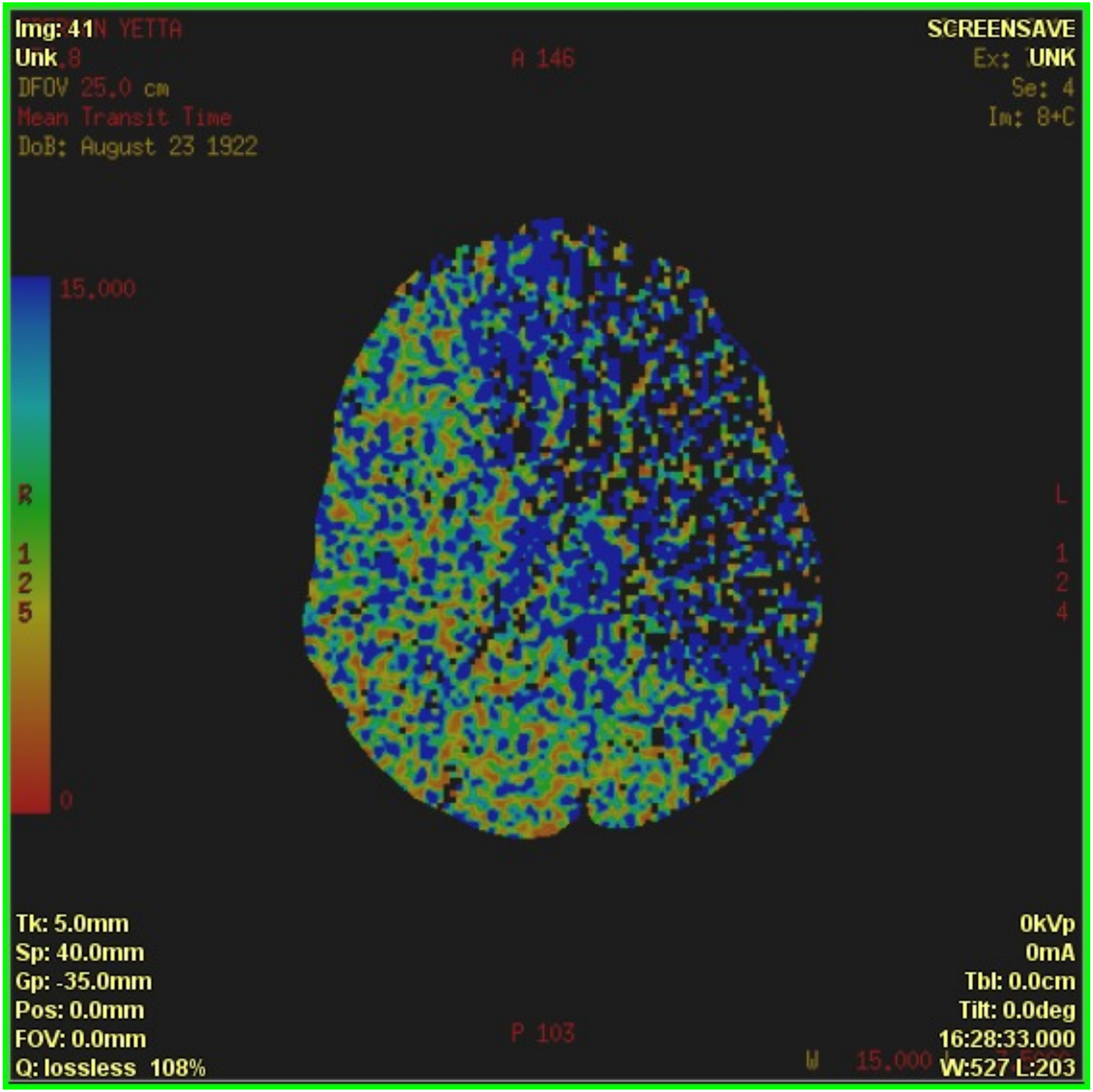

Img: 30N YETTA
Unk 8
DFOV 25.0 cm
Blood Volume
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 13+C
10.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:556 L:248

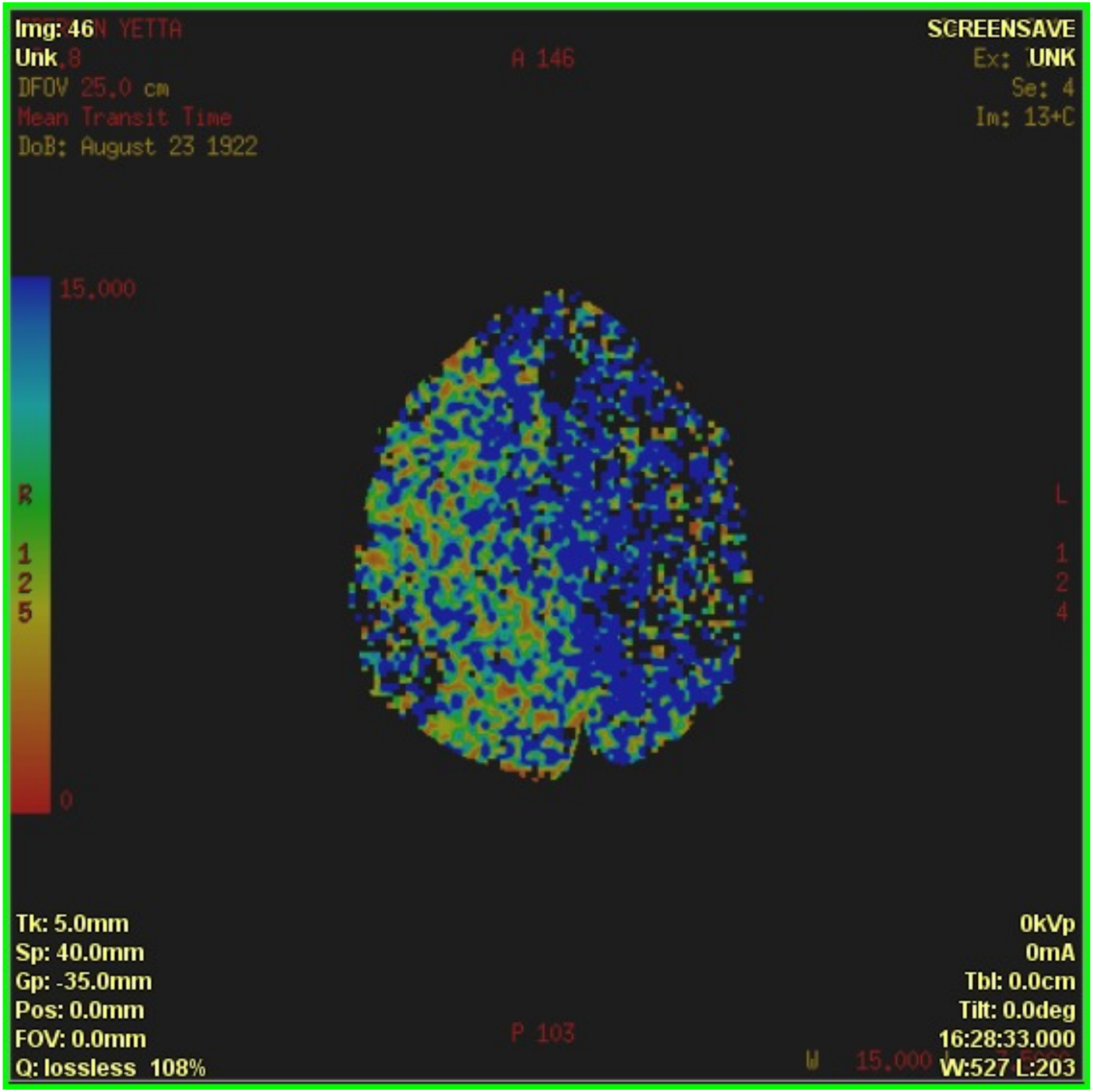

Img: 34N YETTA
Unk,8
DFOV 25.0 cm
Mean Transit Time
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 1+C
15.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

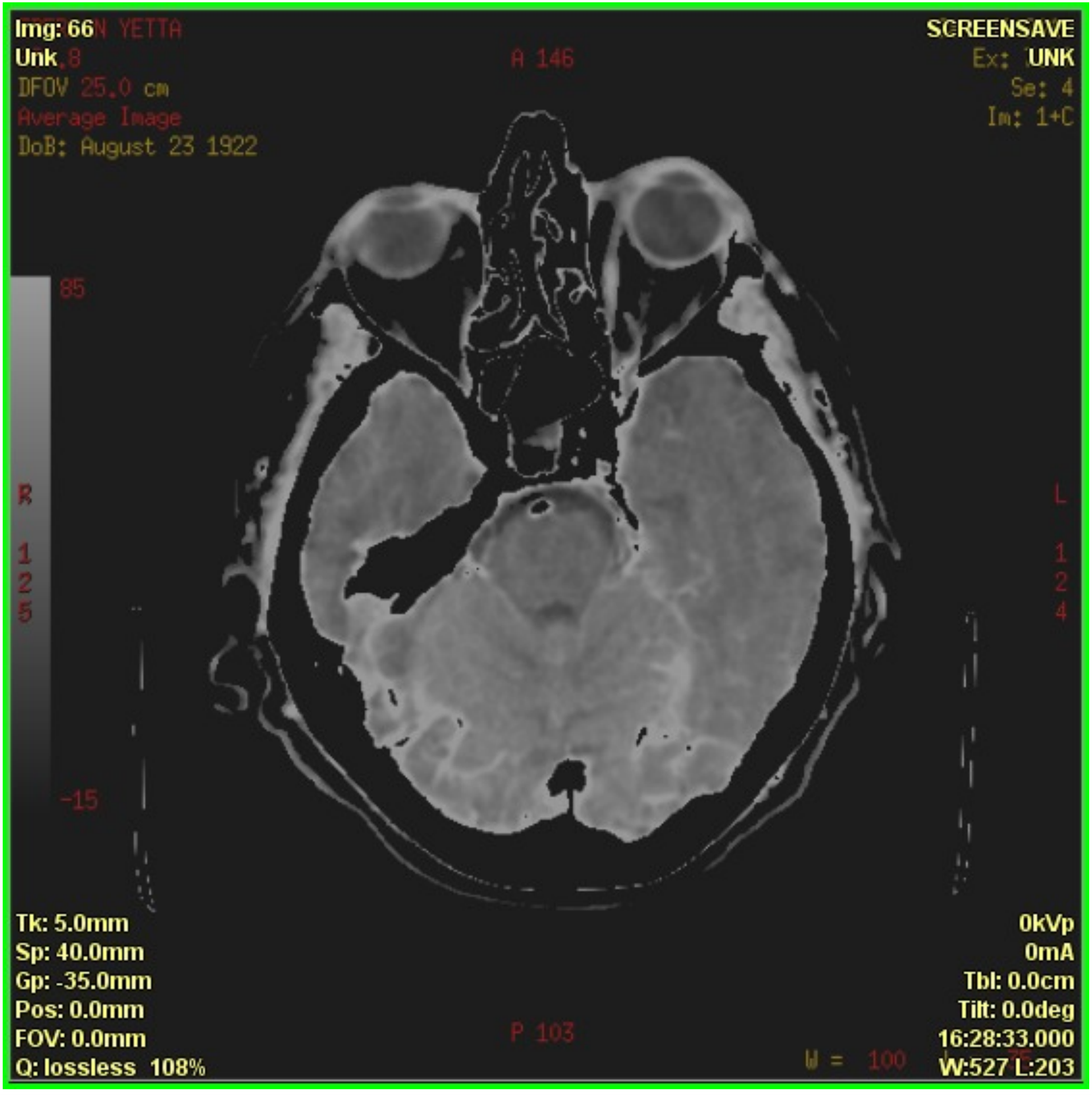

Img: 35
Unk,8
DFOV 25.0 cm
Mean Transit Time
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 2+C
15.000
R
1
2
5
0
Artery
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI
1
Avg.
0
Dev.
0
P 103
W 15.000
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

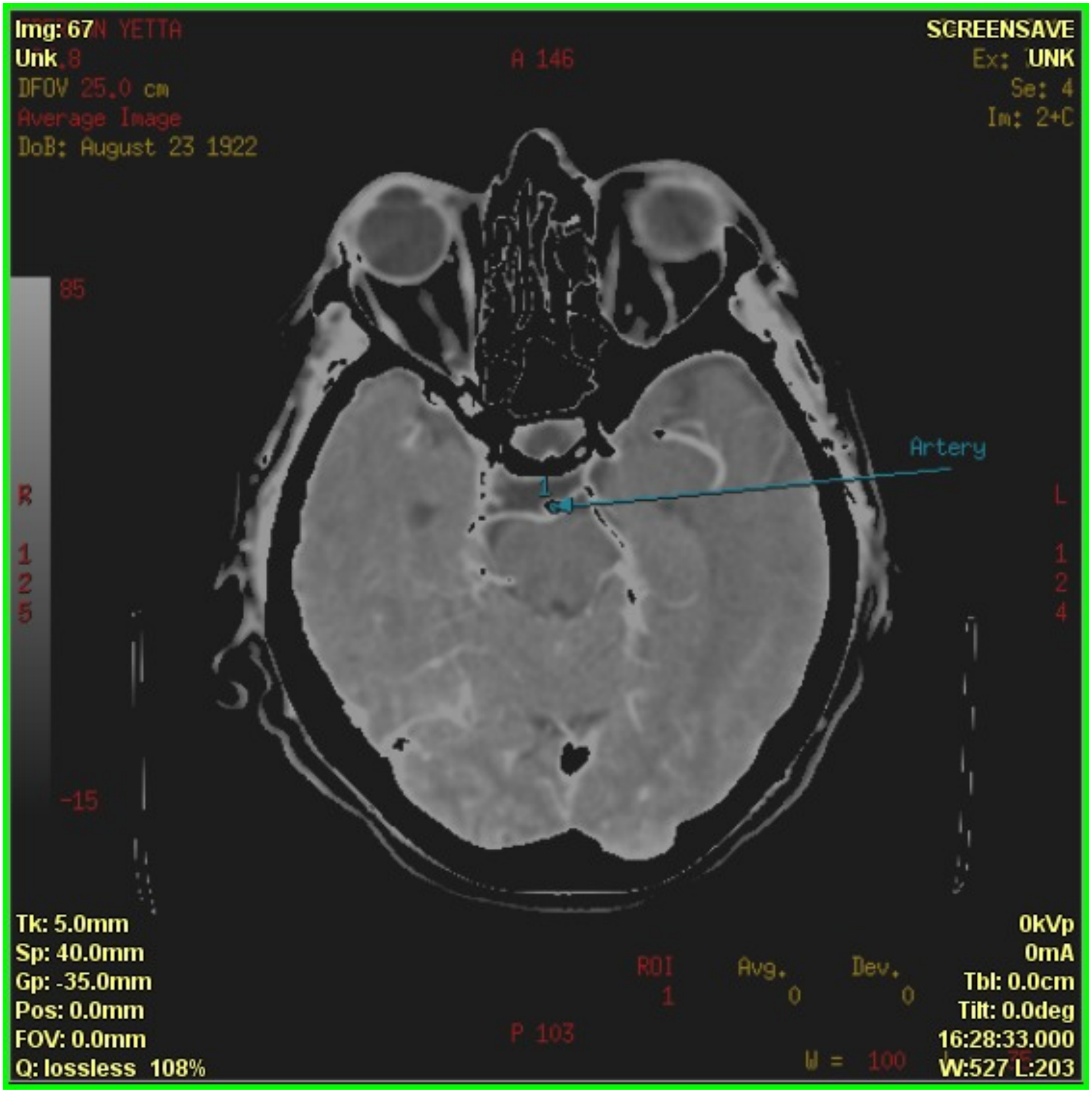

Img: 37
Unk.8
DFOV 25.0 cm
Mean Transit Time
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 4+C
15.000
R
1
2
5
0
L
1
2
4
Vein
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI
Avg.
Dev.
2
0
0
P 103
W 15.000
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

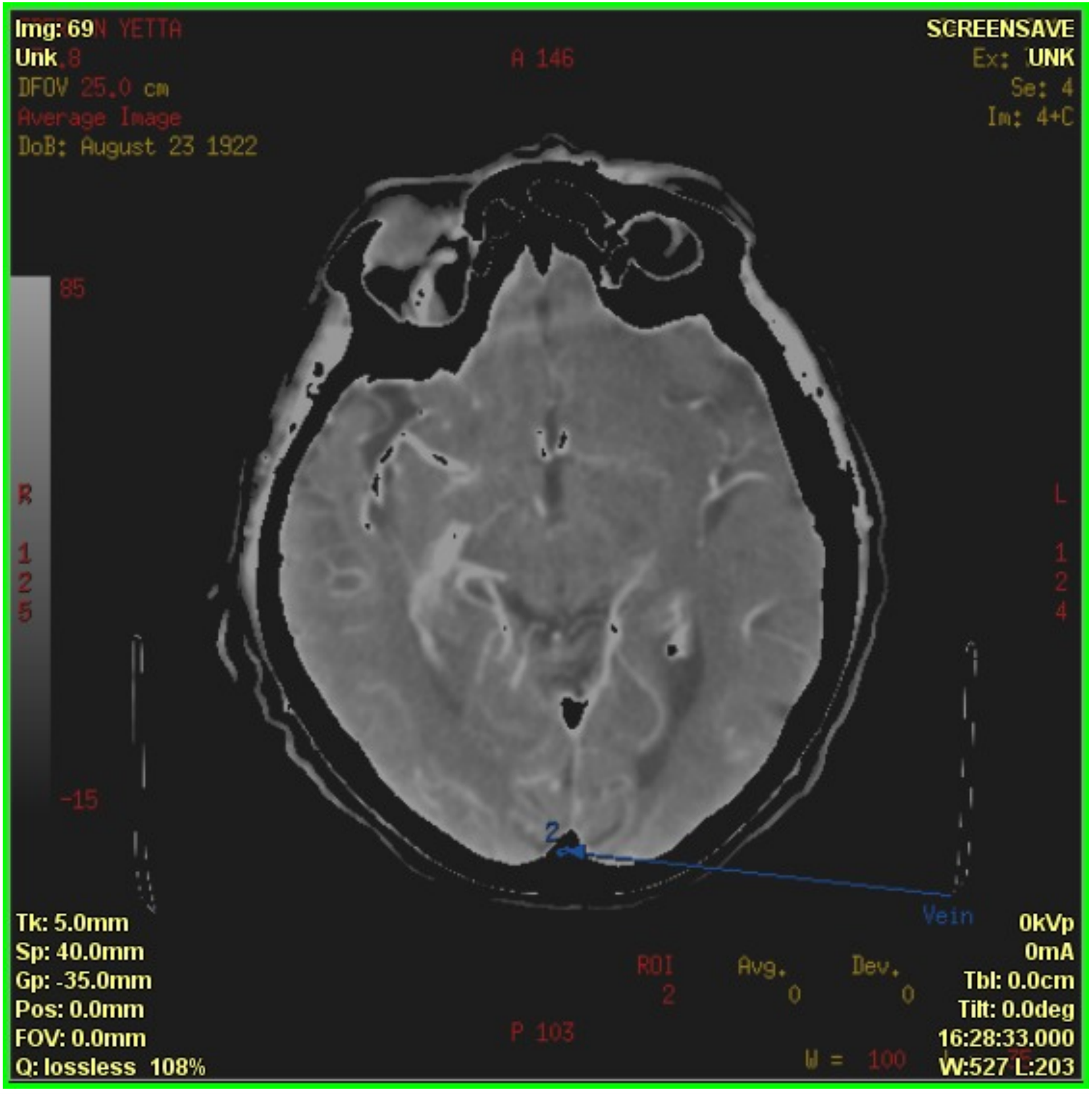

Img: 39N YETTA
Unk.8
DFOV 25.0 cm
Mean Transit Time
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 6+C
15.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

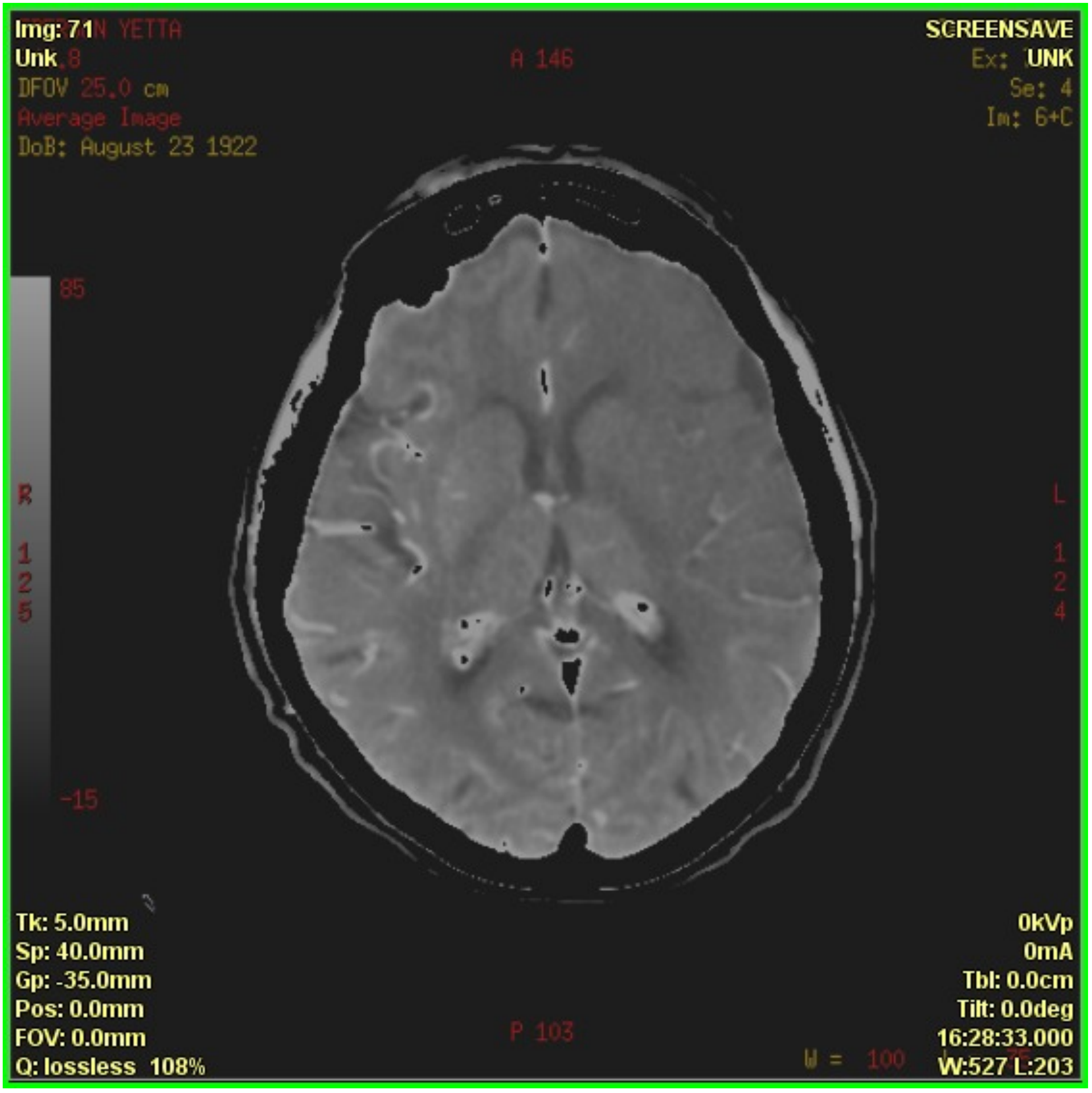

Img: 41N YETTA
Unk,8
DFOV 25.0 cm
Mean Transit Time
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 8+C
15.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

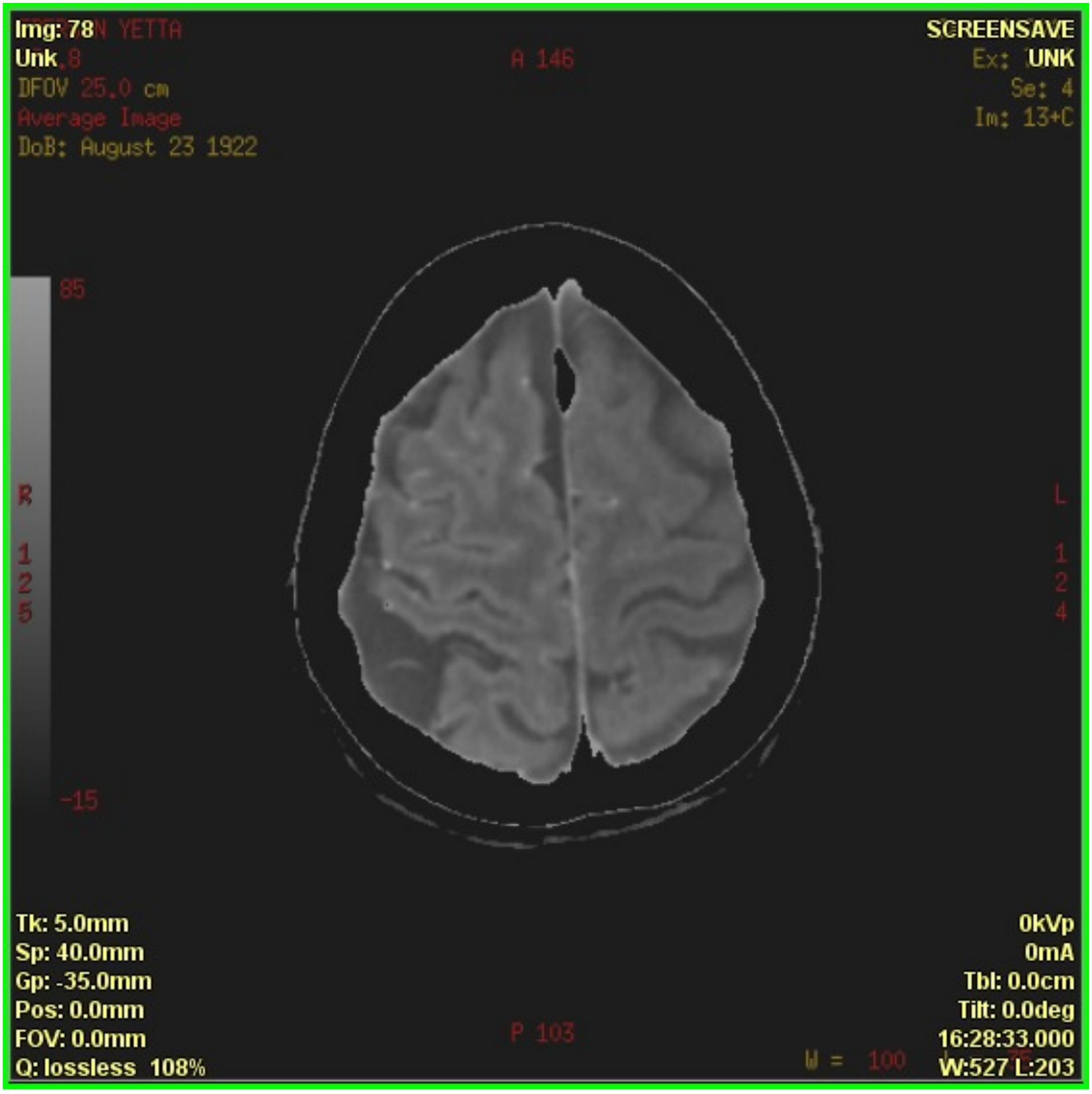

Img: 46N YETTA
Unk,8
DFOV 25.0 cm
Mean Transit Time
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 13+C
15.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
W 15.000
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

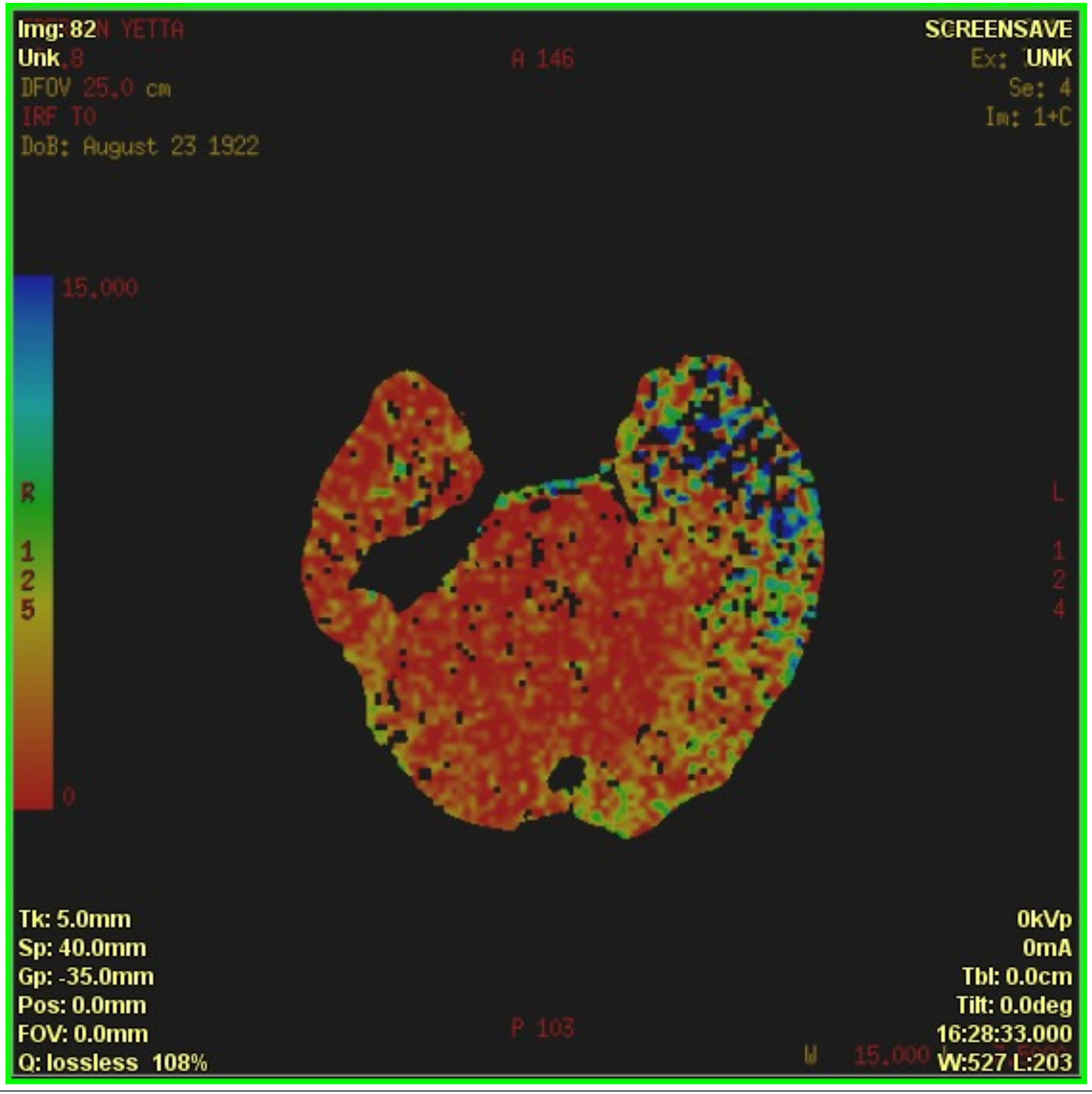

Img: 66N YETTA
Unk,8
DFOV 25.0 cm
Average Image
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 1+C
85
R
1
2
5
-15
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

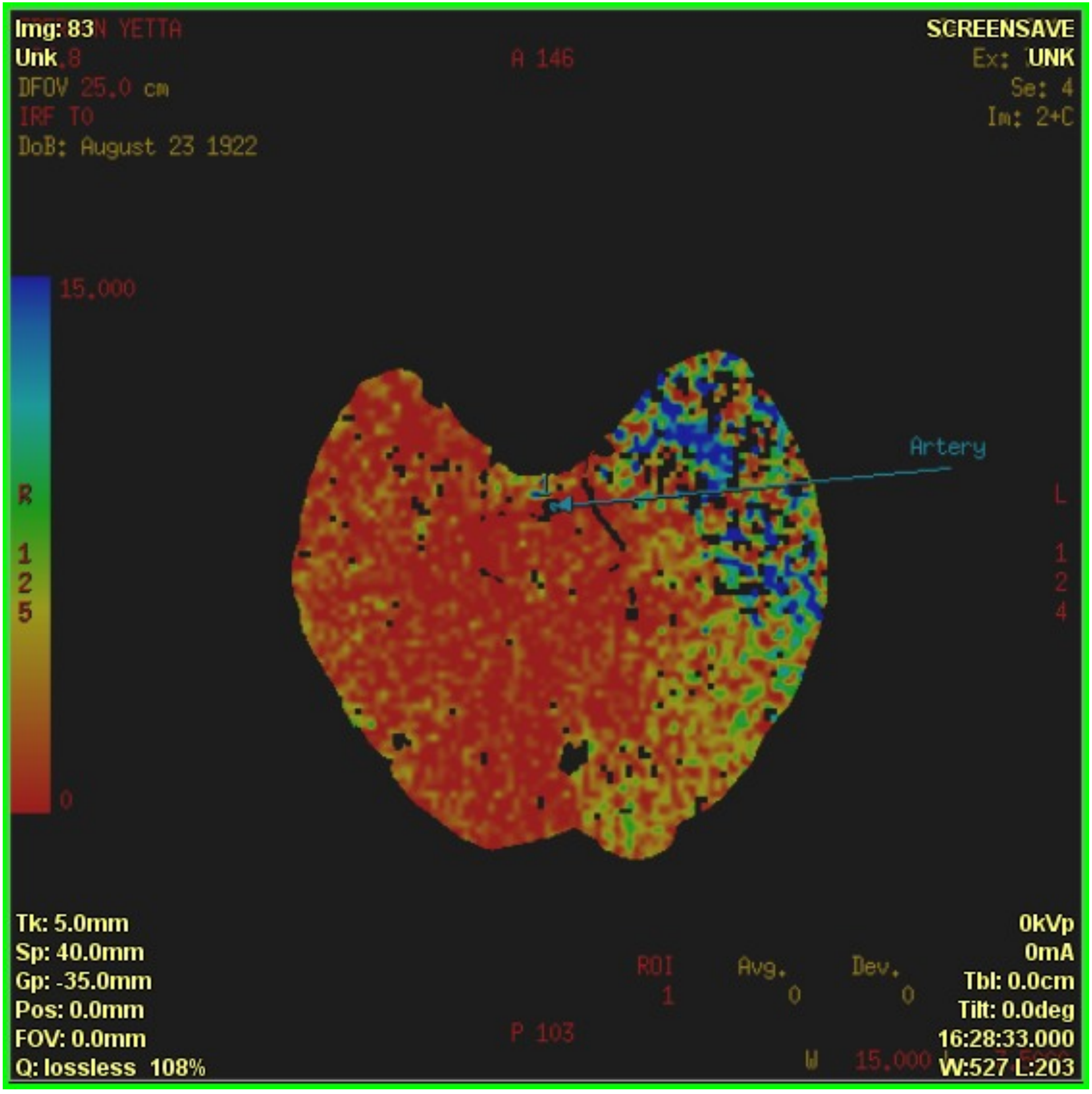

Img: 67
Unk.8
DFOV 25.0 cm
Average Image
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 2+C
85
-15
R
L
Artery
1
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI Avg. Dev.
1 0 0
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

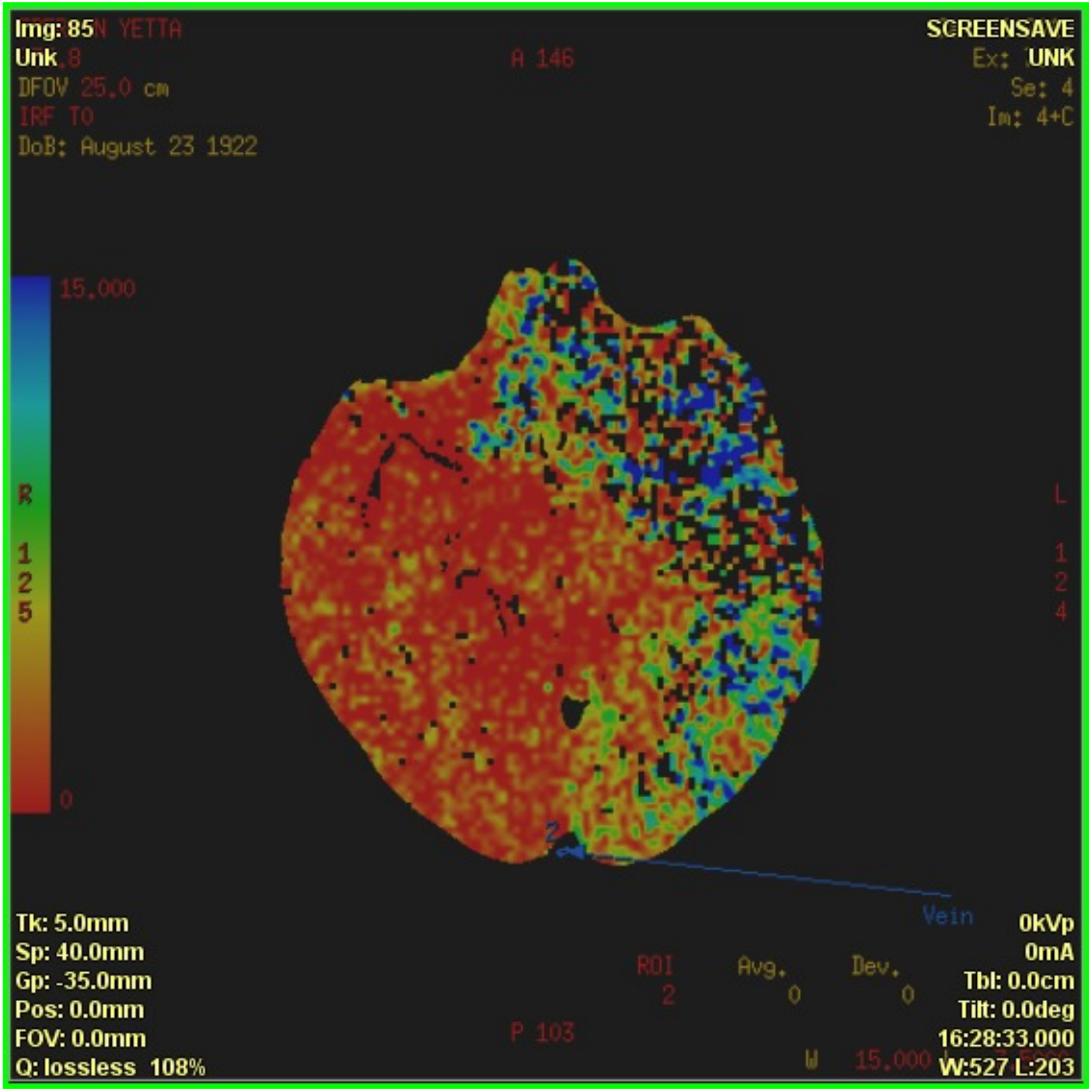

Img: 69N YETTA
Unk.8
DFOV 25.0 cm
Average Image
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 4+C
85
R
1
2
5
L
1
2
4
-15
2
Vein
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI
2
Avg.
0
Dev.
0
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

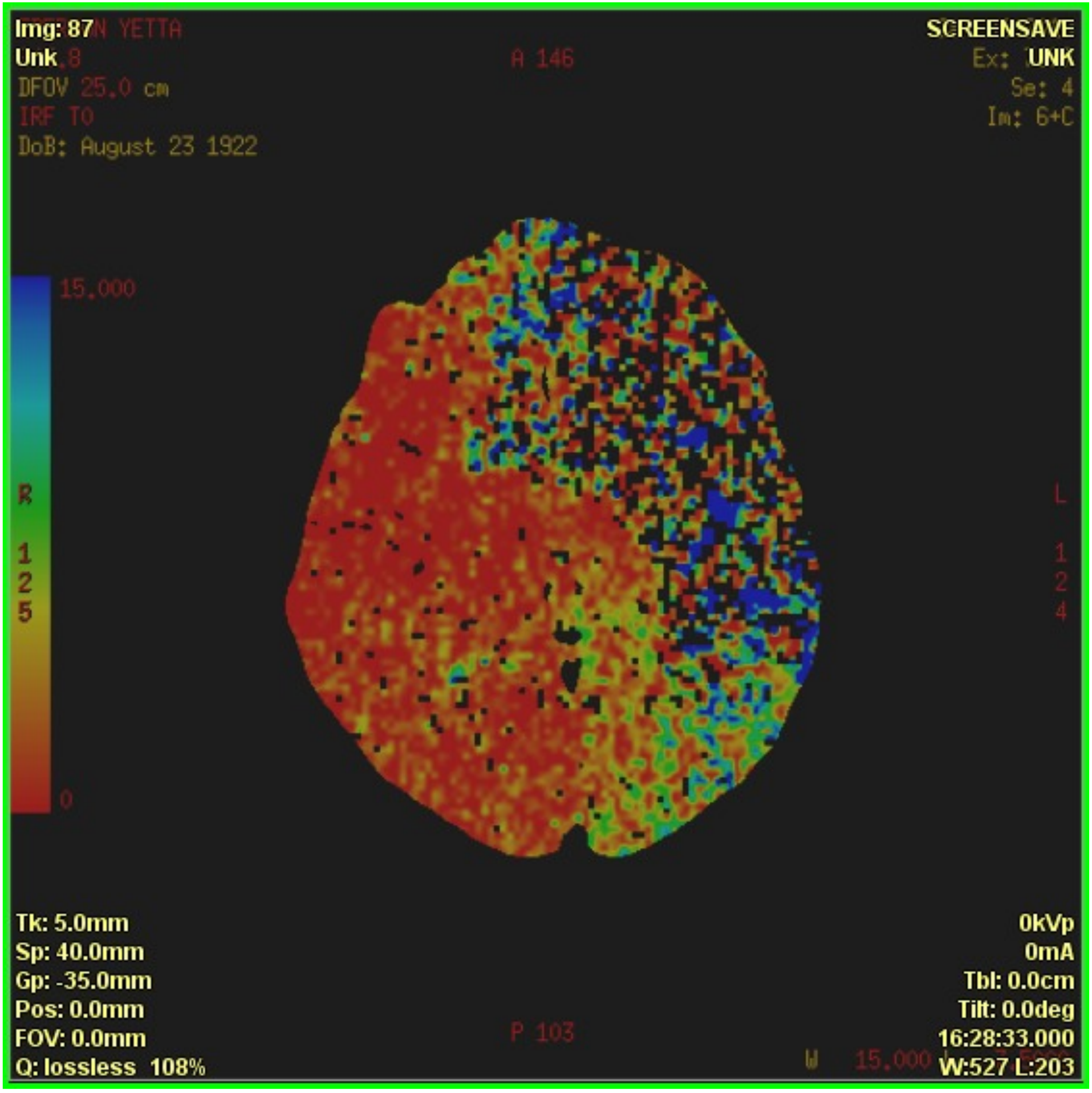

Img: 71N YETTA
Unk,8
DFOV 25.0 cm
Average Image
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 6+C
85
R
1
2
5
-15
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

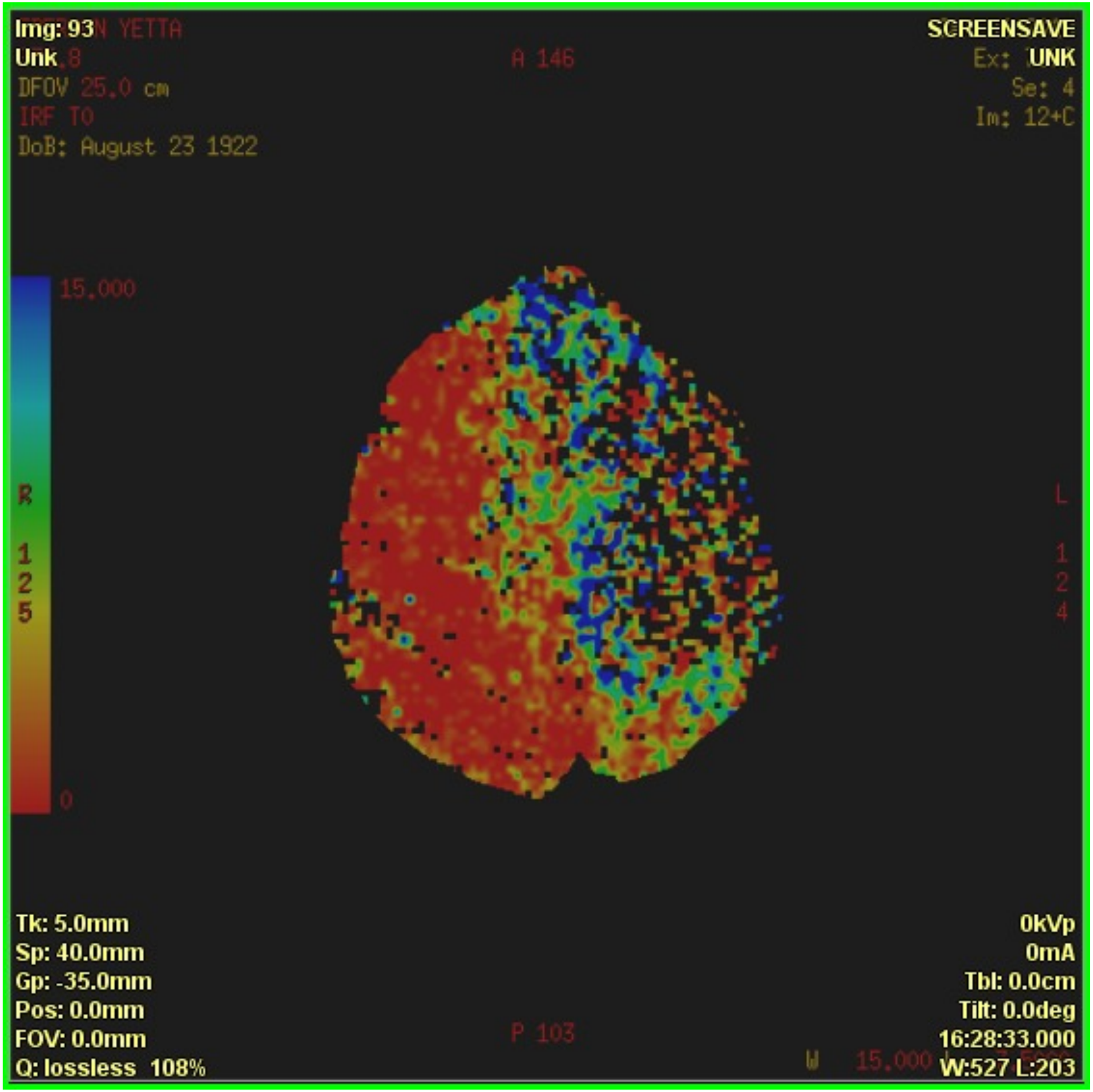

Img: 78N YETTA
Unk,8
DFOV 25.0 cm
Average Image
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 13+C
85
R
1
2
5
-15
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
W = 100
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203


Img: 82N YETTA
Unk,8
DFOV 25.0 cm
IRF TO
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 1+C
15.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203


Img: 83N YETTA
Unk,8
DFOV 25.0 cm
IRF TO
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 2+C
15.000
R
1
2
5
0
Artery
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI
1
Avg.
0
Dev.
0
P 103
W 15.000
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203


Img: 85
Unk.8
DFOV 25.0 cm
IRF TO
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 4+C
15.000
R
1
2
5
0
L
1
2
4
Vein
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
ROI Avg. Dev.
2 0 0
P 103
W 15.000
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203


Img: 87
Unk.8
DFOV 25.0 cm
IRF TO
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 6+C
15.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203


Img: 93N YETTA
Unk,8
DFOV 25.0 cm
IRF TO
DoB: August 23 1922
A 146
SCREENSAVE
Ex: UNK
Se: 4
Im: 12+C
15.000
R
1
2
5
0
L
1
2
4
Tk: 5.0mm
Sp: 40.0mm
Gp: -35.0mm
Pos: 0.0mm
FOV: 0.0mm
Q: lossless 108%
P 103
0kVp
0mA
Tbl: 0.0cm
Tilt: 0.0deg
16:28:33.000
W:527 L:203

INDICATIONS: Stroke. Prior to this study, patient received TPA.

TECHNIQUE :
CT head without contrast
CT angiogram of head and neck with multiplanar MIP reconstruction in 3 planes.
CT perfusion with volume shuttle low dose technique through the entire supratentorial brain. Postporcessed perfusion maps.

Total contrast administered: 90 mL of Visipaque 320.

FINDINGS:
CT head without contrast shows loss of gray-white matter differentiation in the left middle cerebral artery territory and insular cortex. Hyperdense left MCA is noted on the images and 9 of series 2. No intracranial bleed or midline shift or mass, or hydronephrosis or herniation is seen.

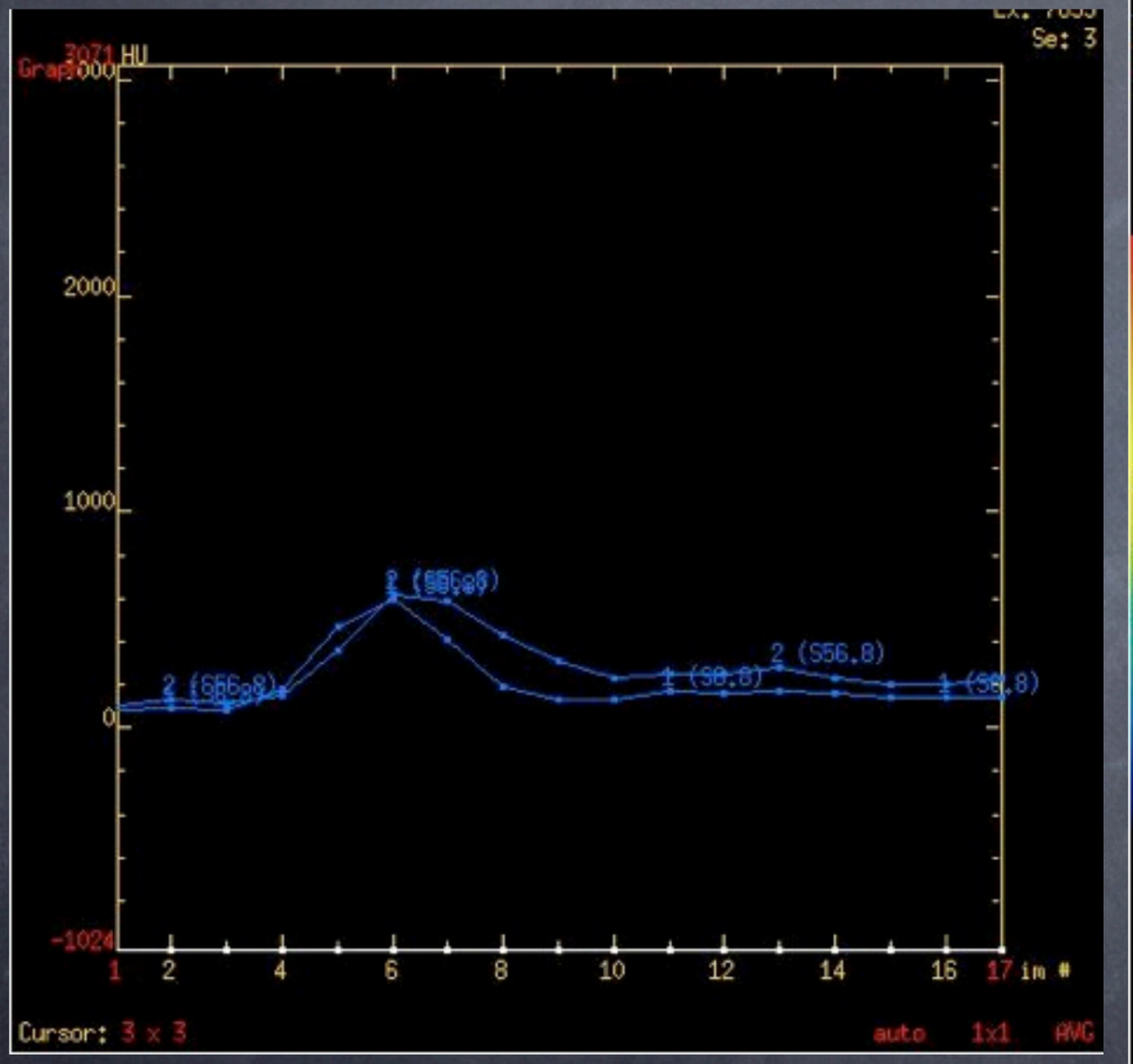
CT angiogram of the neck shows unremarkable origins of the great vessels. The vertebral artery remains patent throughout. Small calcification is noted in the left carotid bulb. This results in less than 50% stenosis. There is no stenosis in the right carotid bulb. There is decreased density in the left internal carotid artery compared to the right.

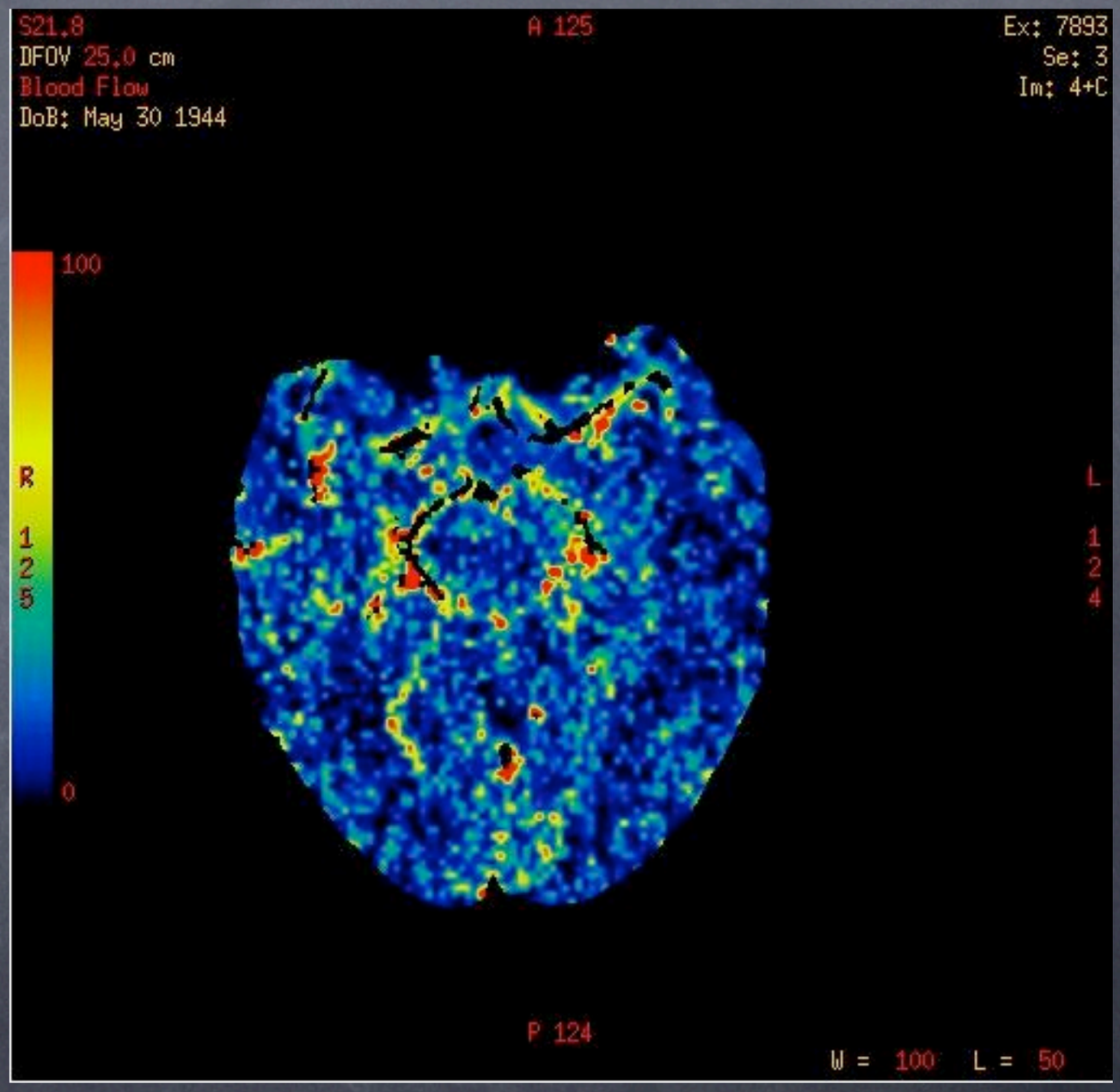
CT angiogram of head shows decreased contrast opacification of the left internal carotid artery and decreased opacification of the left A1 and M1 branch. There is no contrast in the left MCA distribution beyond the proximal left M1. Bilateral posterior communicating artery is present. There is poor contrast opacification of the both A2 branches.

CT perfusion study demonstrates a proximal 9 mm long occlusion of the proximal left MCA with delayed retrograde contrast opacification distal beyond the clot. The cerebral blood flow is significant diminished through the entire left MCA distribution as well as both anterior cerebral distribution. There is significantly decreased cerebral blood volume in the entire left MCA and proximal left A1 distribution. The mismatch is essentially in the part of the anterior cerebral territory. There is matched perfusion and cerebral blood volume defects in the entire left MCA distribution. No significant penumbra is seen.

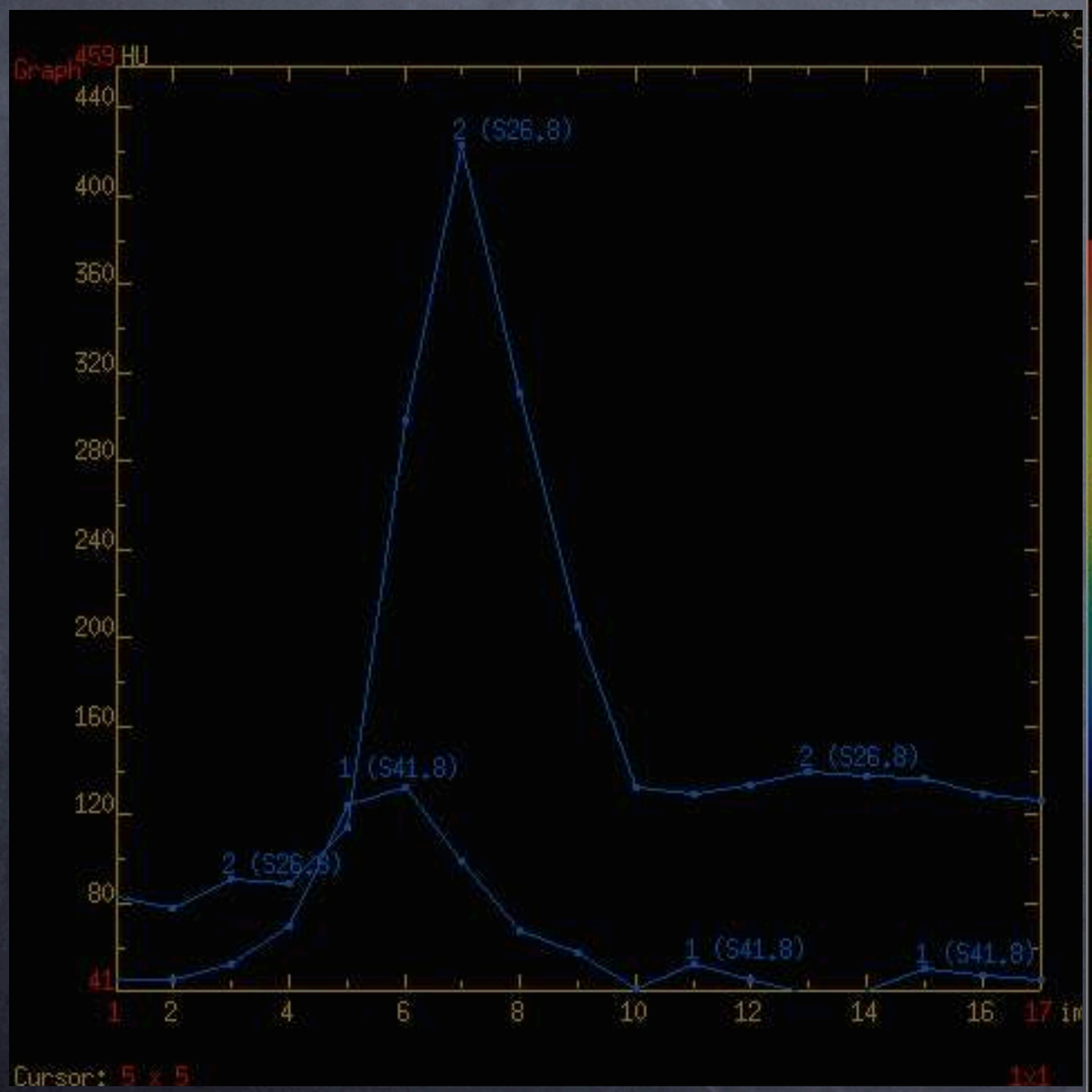
IMPRESSION: Patient received TPA prior to imaging. There is occlusion of the left proximal M1. Although the collateral flow is noted beyond the clot, there is no significant penumbra. Findings were communicated to Dr. Randazzo by Dr. Brezel at the time of imaging.

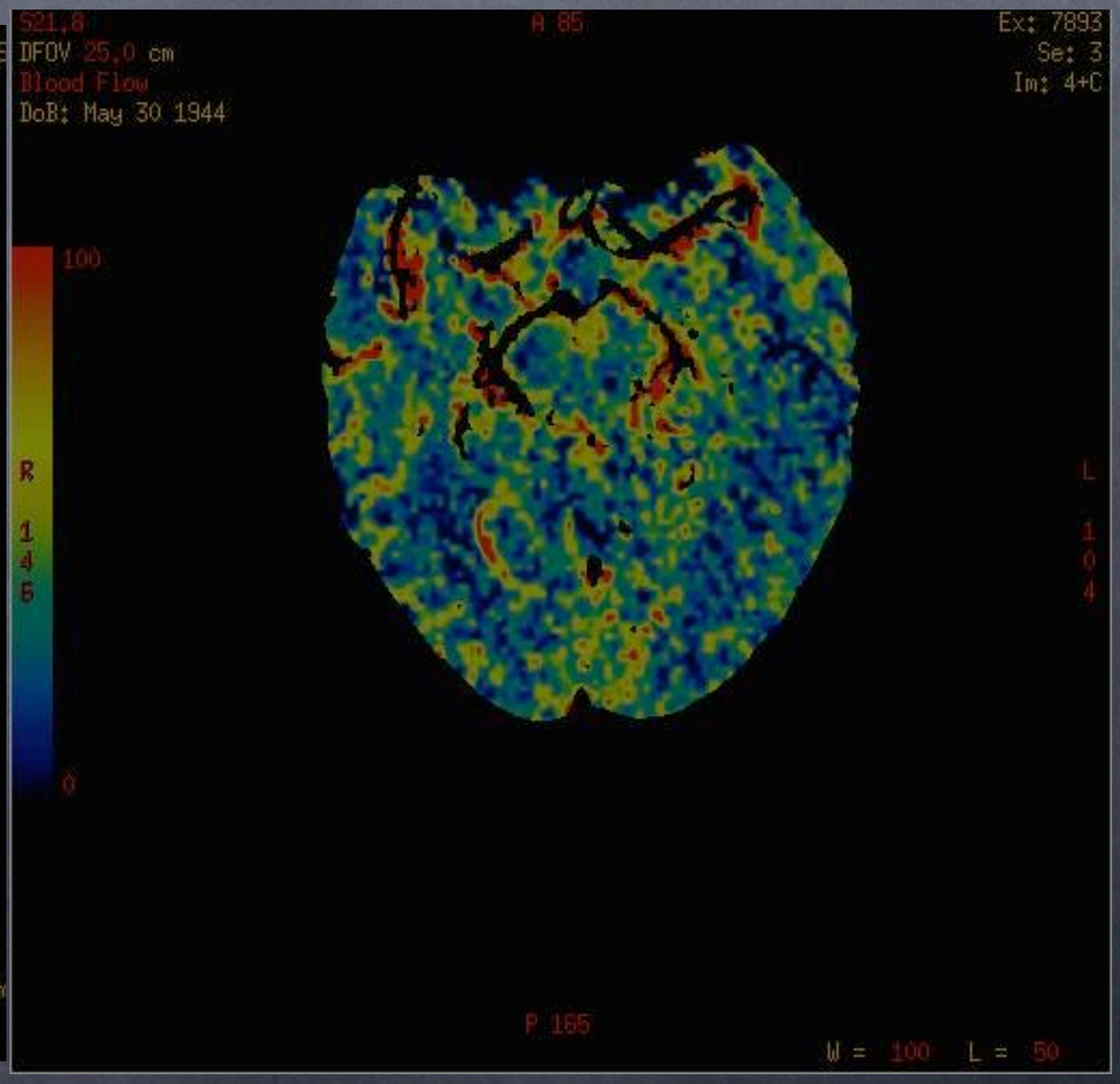
second patient





second pt, reprocessed





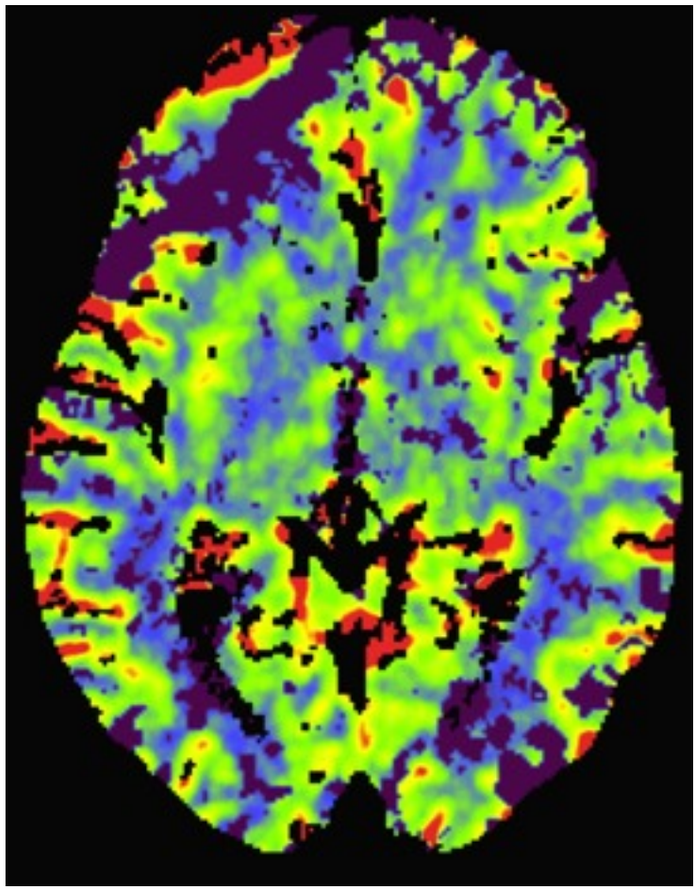
CT Perfusion Artifacts and Interesting Cases

Dr. Lawrence Bub, Night Hawk Radiology

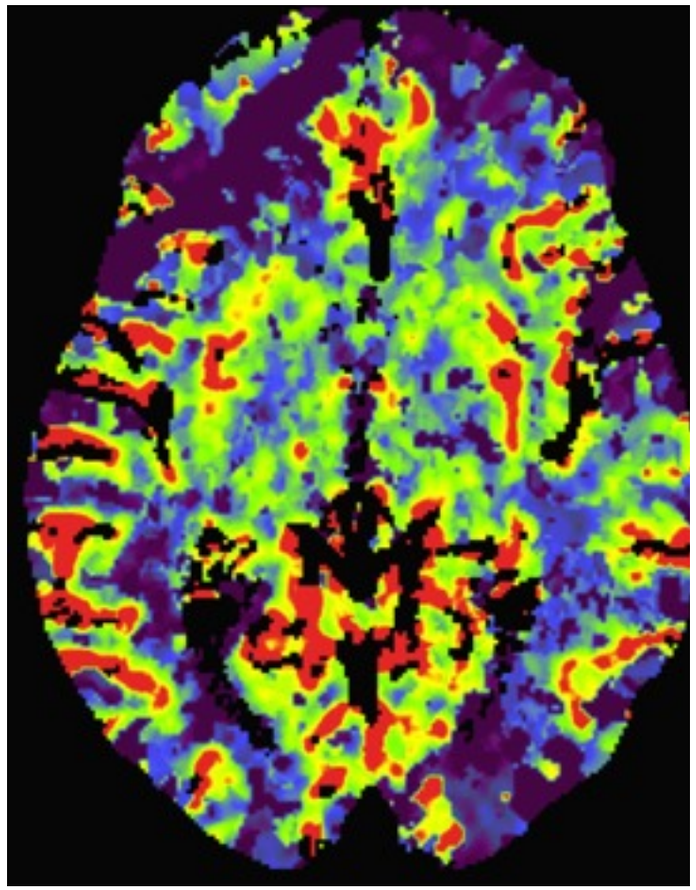
Case 1

Dr. Lawrence Bub, Night Hawk Radiology

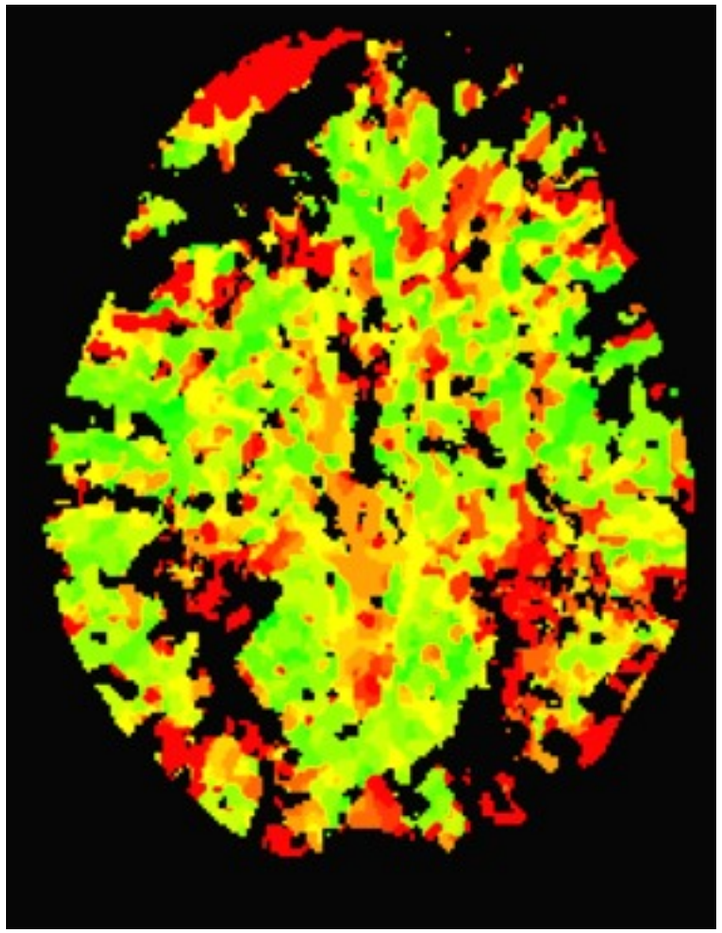
Right Frontal Infarct?



CBV



CBF

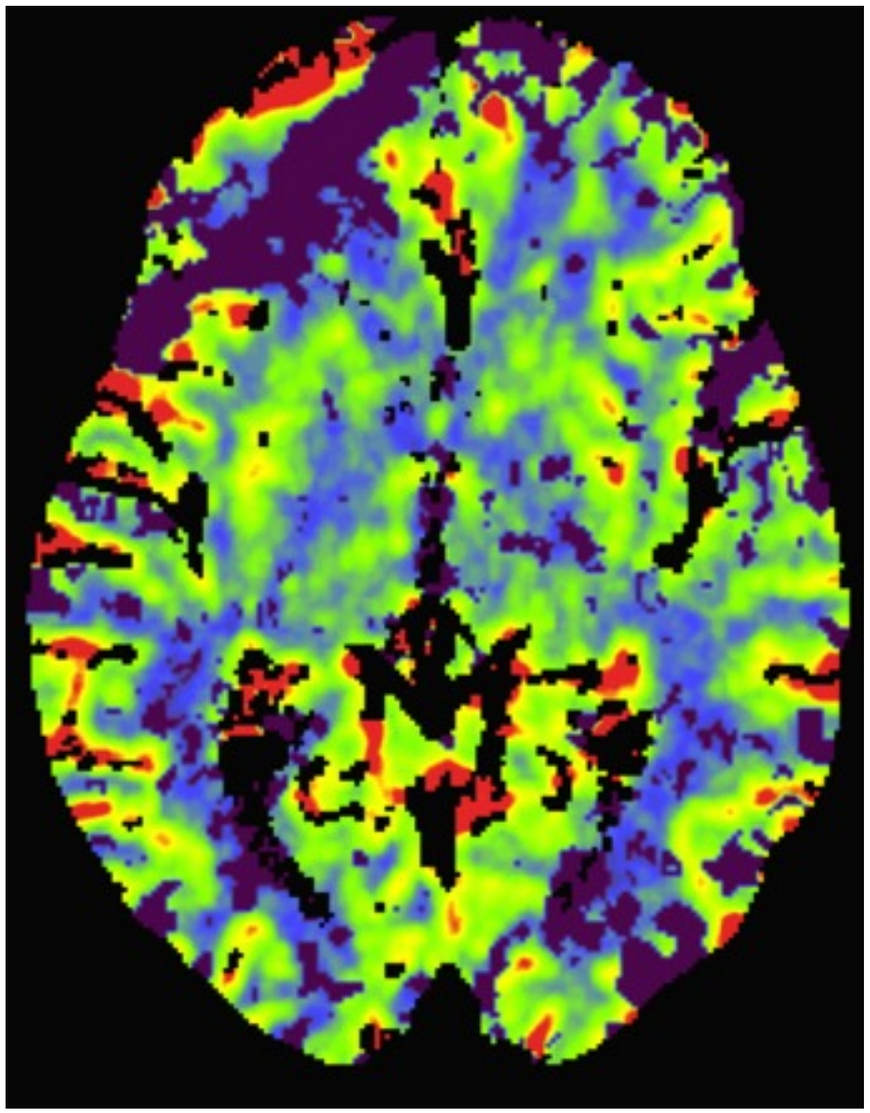


MTT

Dr. Lawrence Bub, Night Hawk Radiology

Streak Artifact:

=>Refer to source images for suspected artifacts; although artifact will often be more prominent on perfusion images.
=>Look for typical locations and linear configuration of streak artifacts, ie close to bone, anterior temporal lobes, posterior fossa, etc.

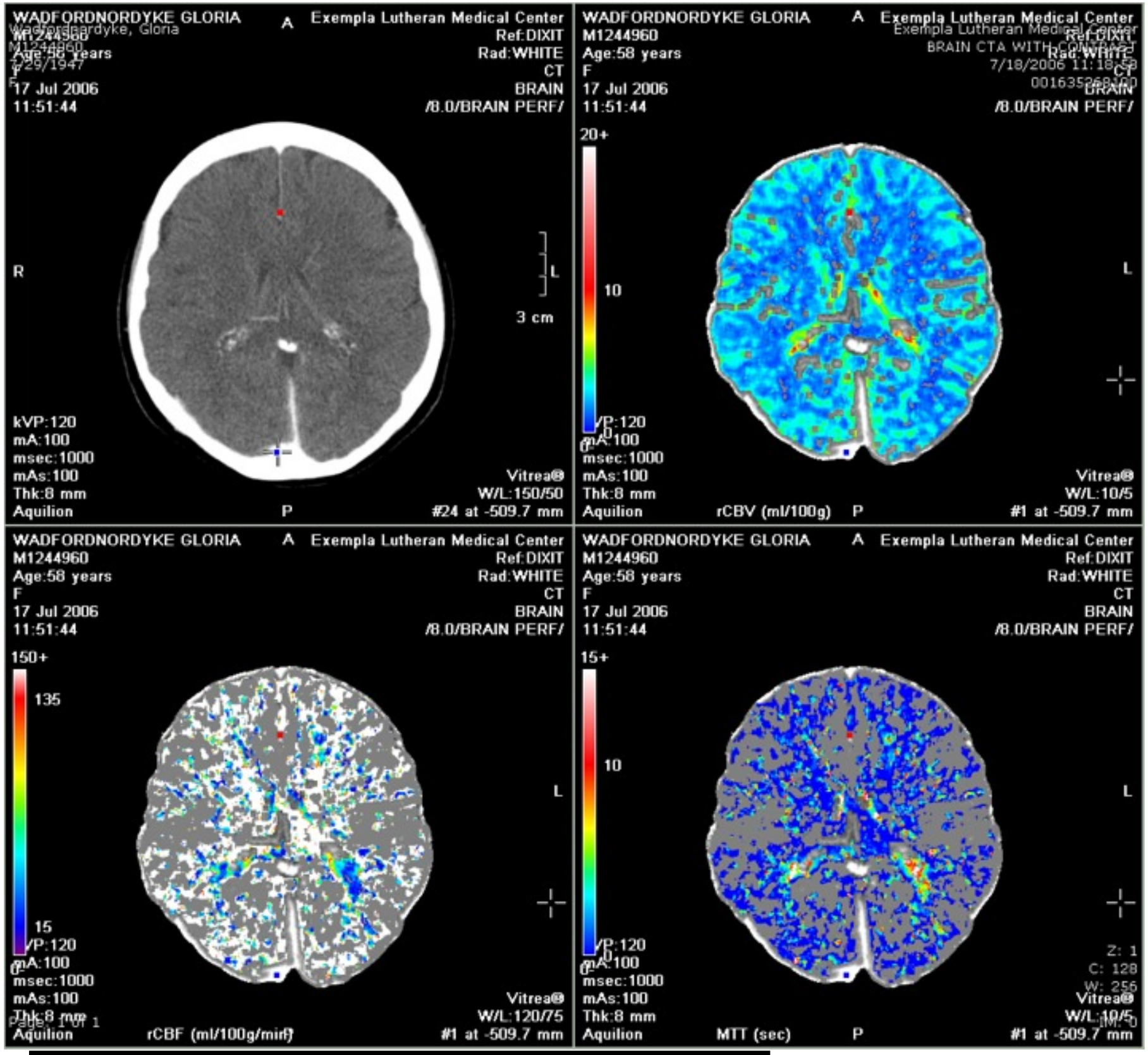


Dr. Lawrence Bub, Night Hawk Radiology

Case 2

Dr. Lawrence Bub, Night Hawk Radiology

What's wrong with this picture?



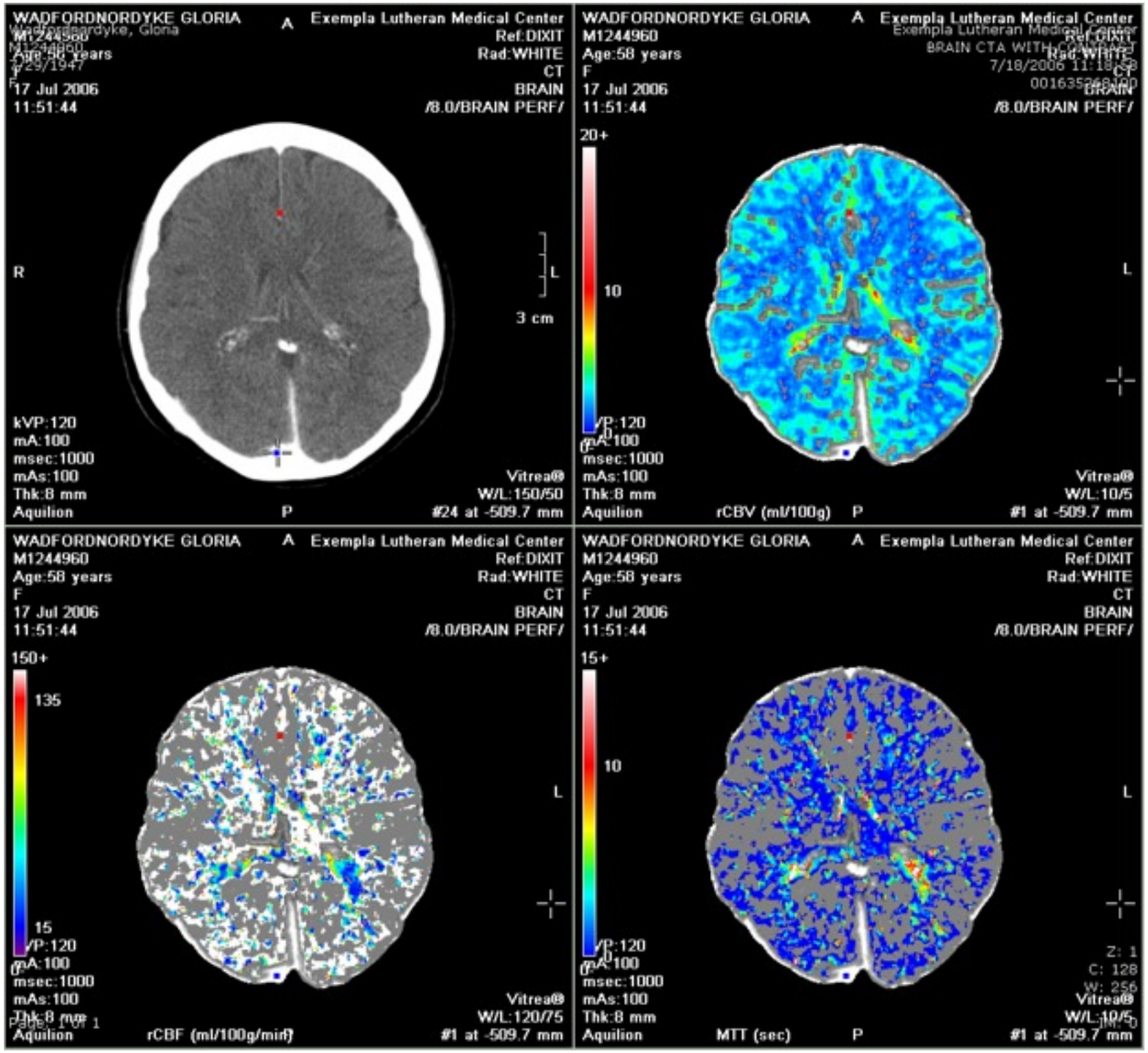
Dr. Lawrence Bub, Night Hawk Radiology

Extremely high CBF (white) and low MTT (blue) in the white matter compared to cortex, which is the opposite of normal.

Artifact: **Arterial ROI placed on a vein.**

While the red dot (arterial ROI) appears to be on the ACA it is likely on an adjacent cortical vein near the ACA.

If arterial and venous time-density curves are available, the arterial curve should peak before the vein, and is usually less dense. They were not available in this case.

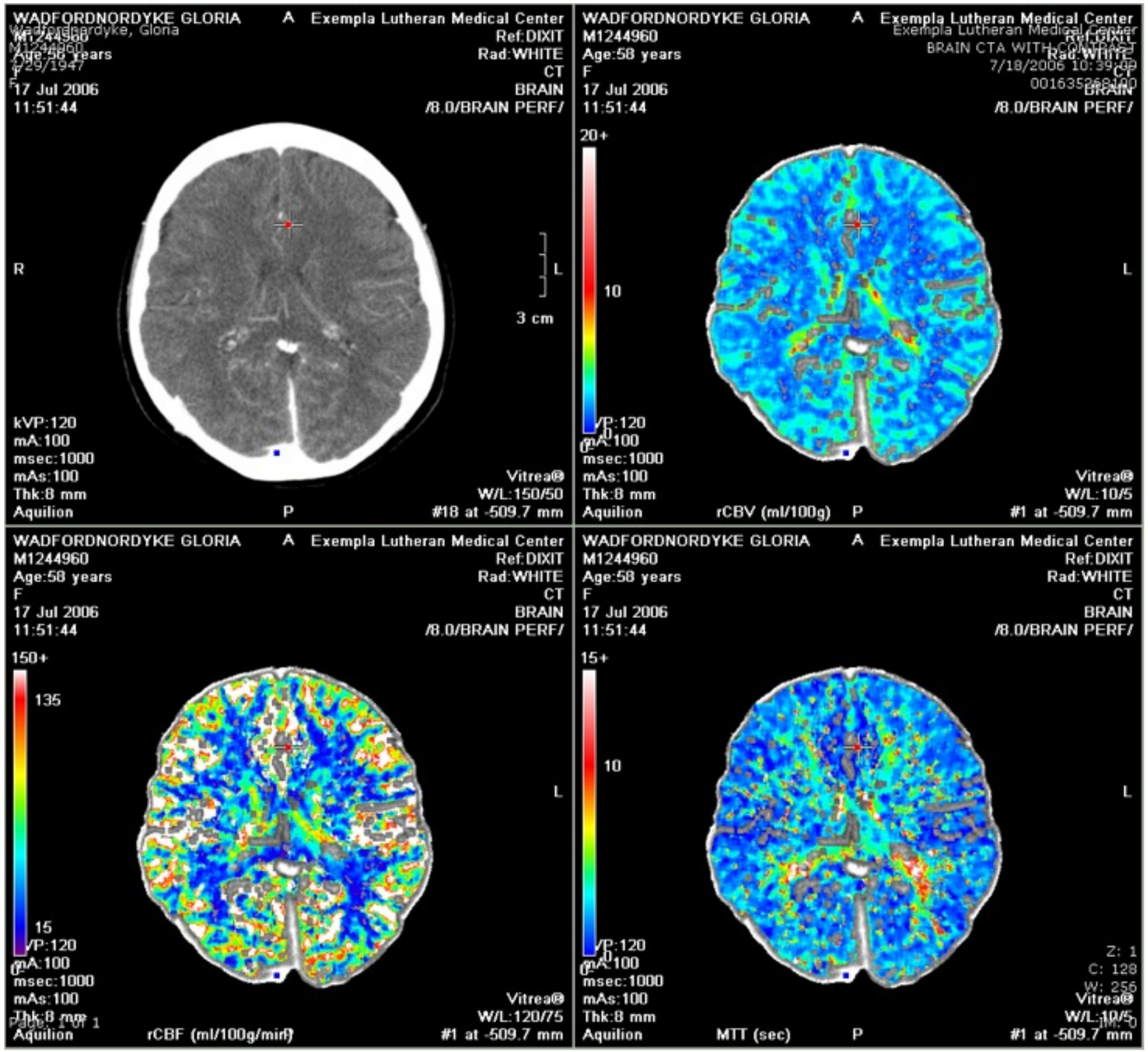


Dr. Lawrence Bub, Night Hawk Radiology

This is what the maps should look like.

Notice that cortex has higher CBF (white) and lower MTT (blue) than adjacent white matter.

Also, note that the arterial ROI was moved to an adjacent smaller vessel, which turns out to be the ACA.

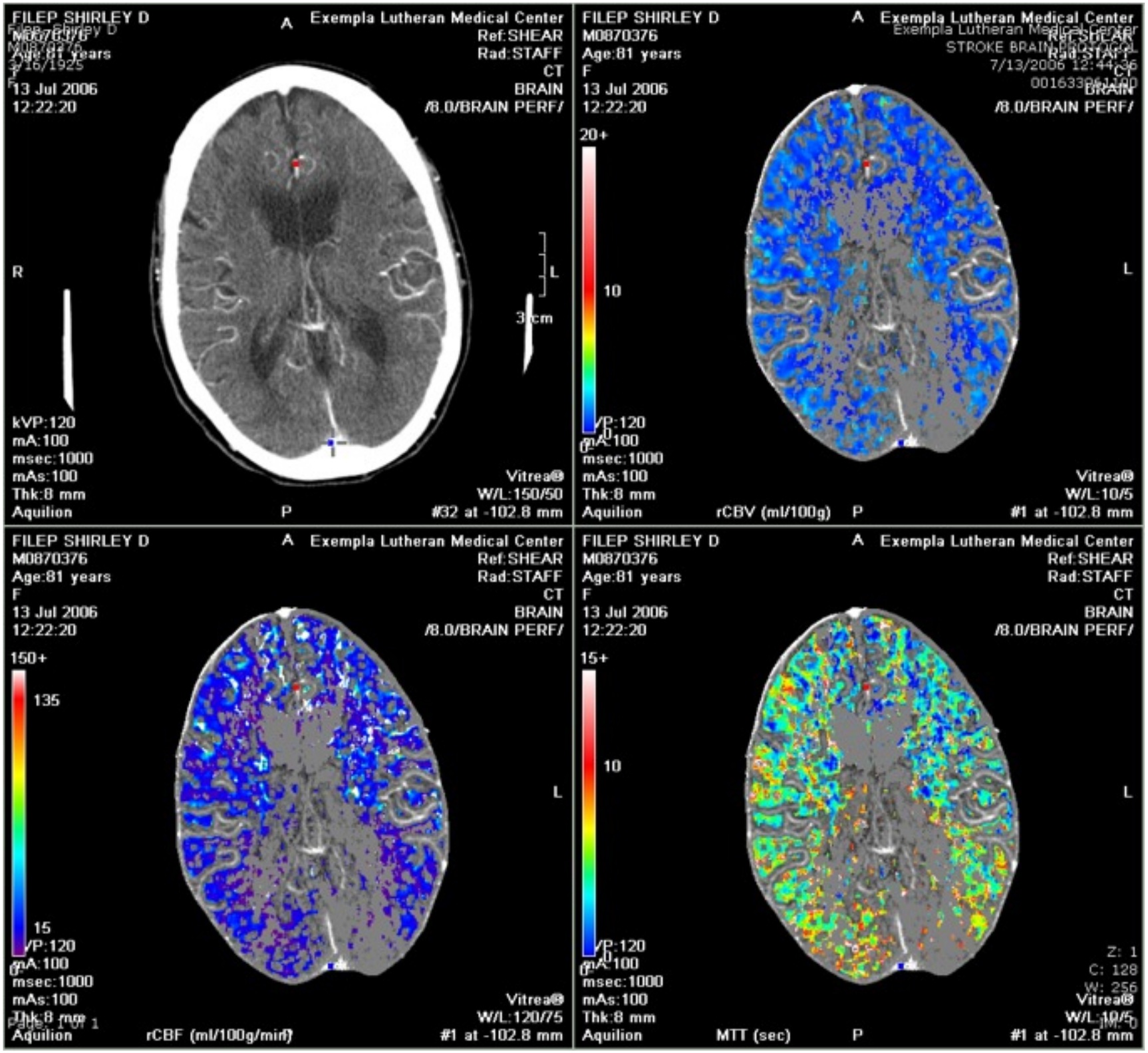


Dr. Lawrence Bub, Night Hawk Radiology

Case 3

Dr. Lawrence Bub, Night Hawk Radiology

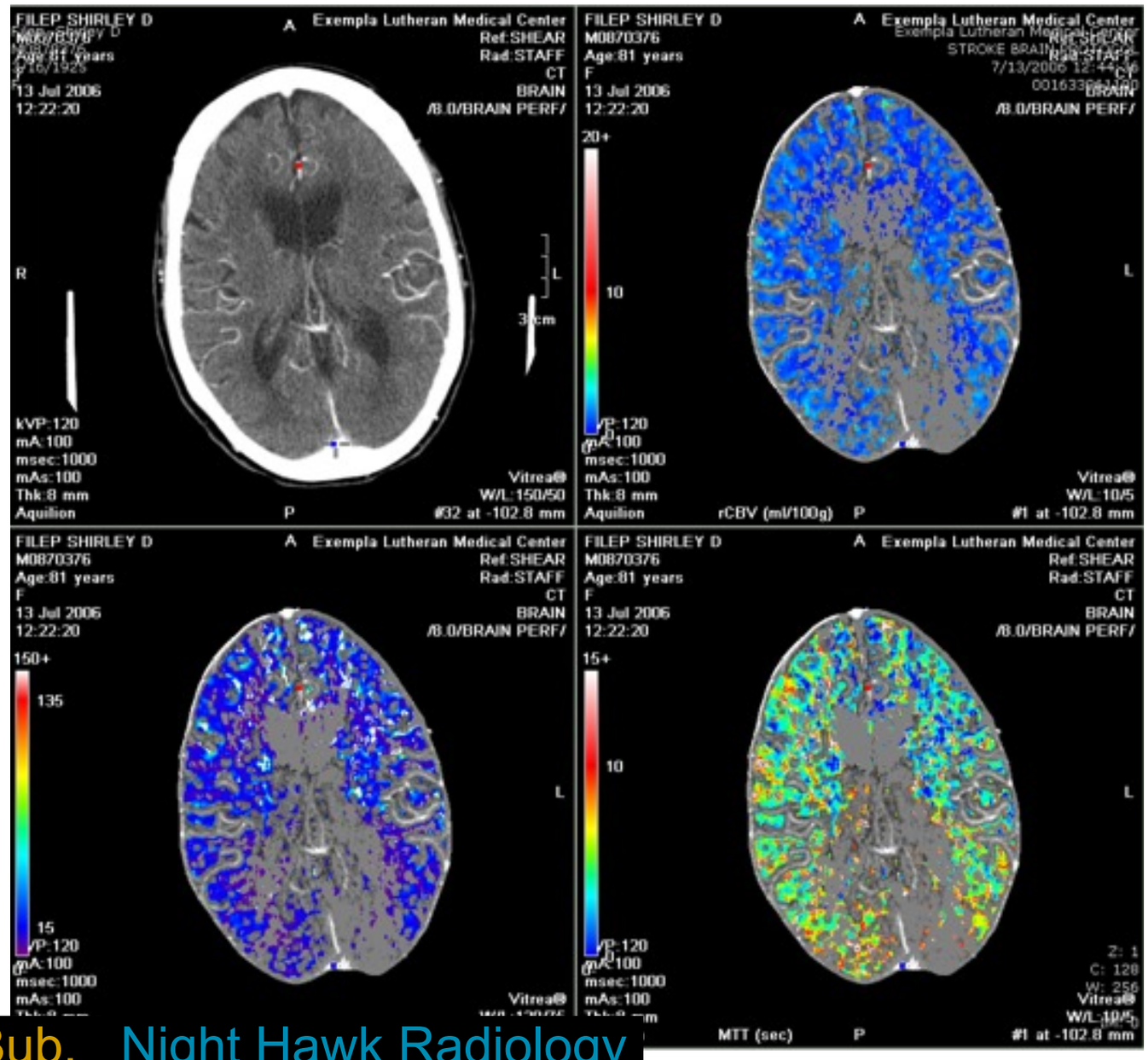
Why does the CBF and CBV look so homogeneous and diffusely low?



Dr. Lawrence Bub, Night Hawk Radiology

This artifact is from very slow intracerebral flow, in which the venous phase has has barely peaked and not completed during the 45 second scan.

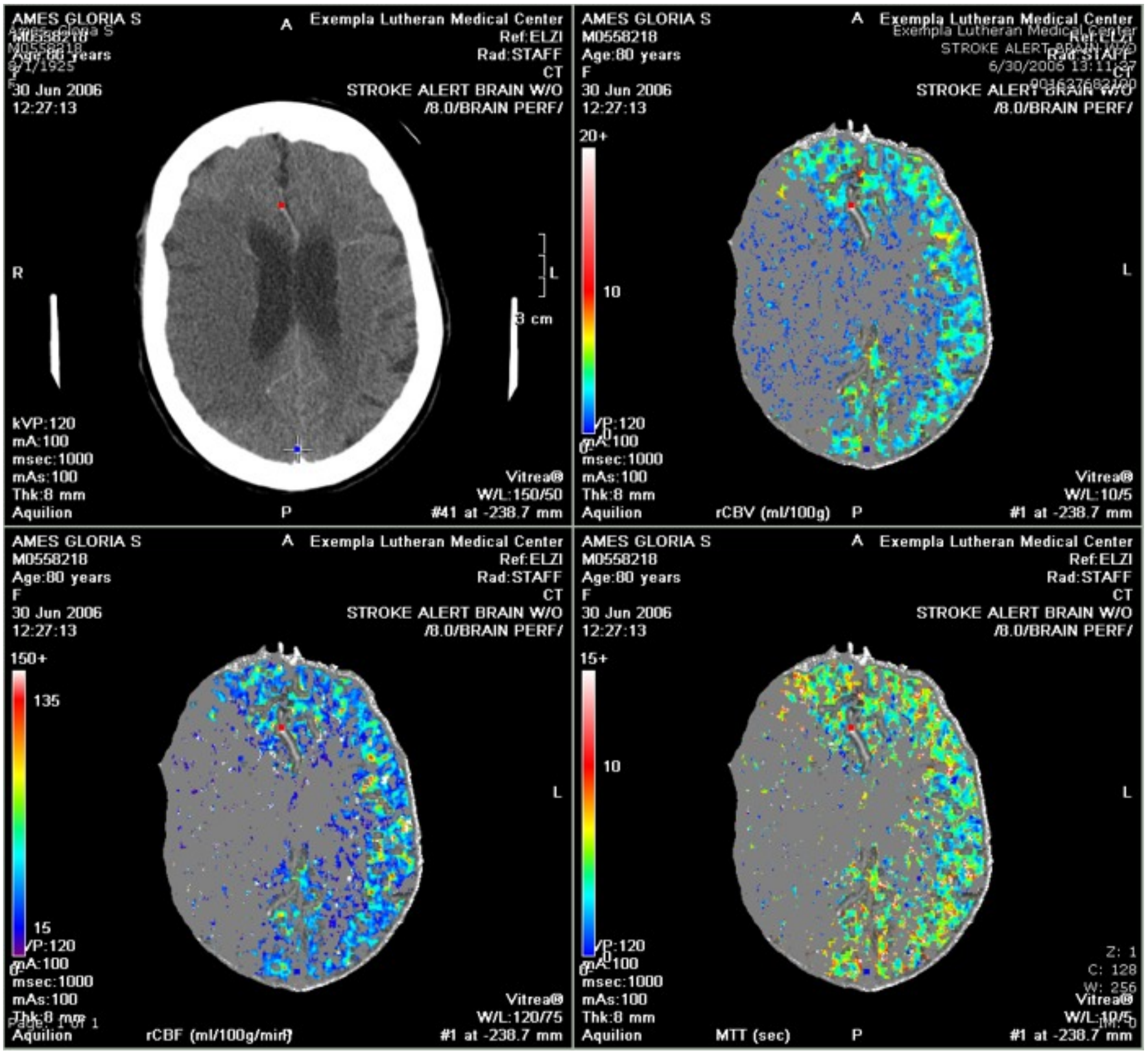
I have seen two of these so far. Both patients had infarcts: note the matching absent color maps in the L PCA territory without chronic infarct on CT. This was confirmed by MRI.



Dr. Lawrence Bub, Night Hawk Radiology

Here is the other similar appearing case.

I have been asked why the MTT is not white (extremely long) in the infarcted region. I think it's because in these patients there is simply no enhancement at all in the infarcted regions during the dynamic scan (45 sec in this case), and we therefore get grey areas without interpretable data.

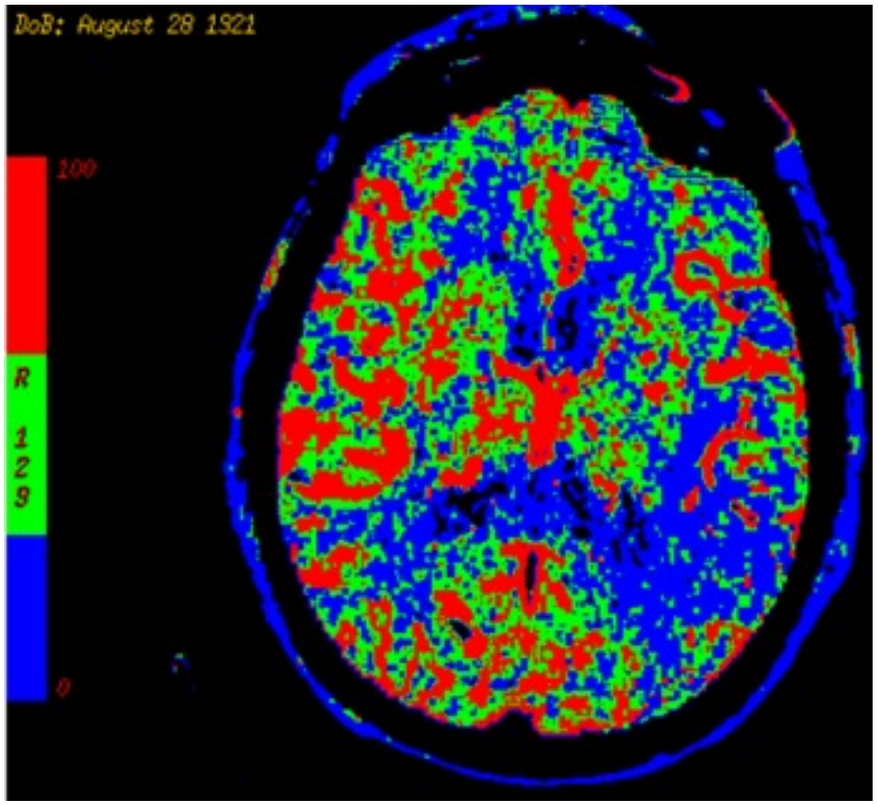


Dr. Lawrence Bub, Night Hawk Radiology

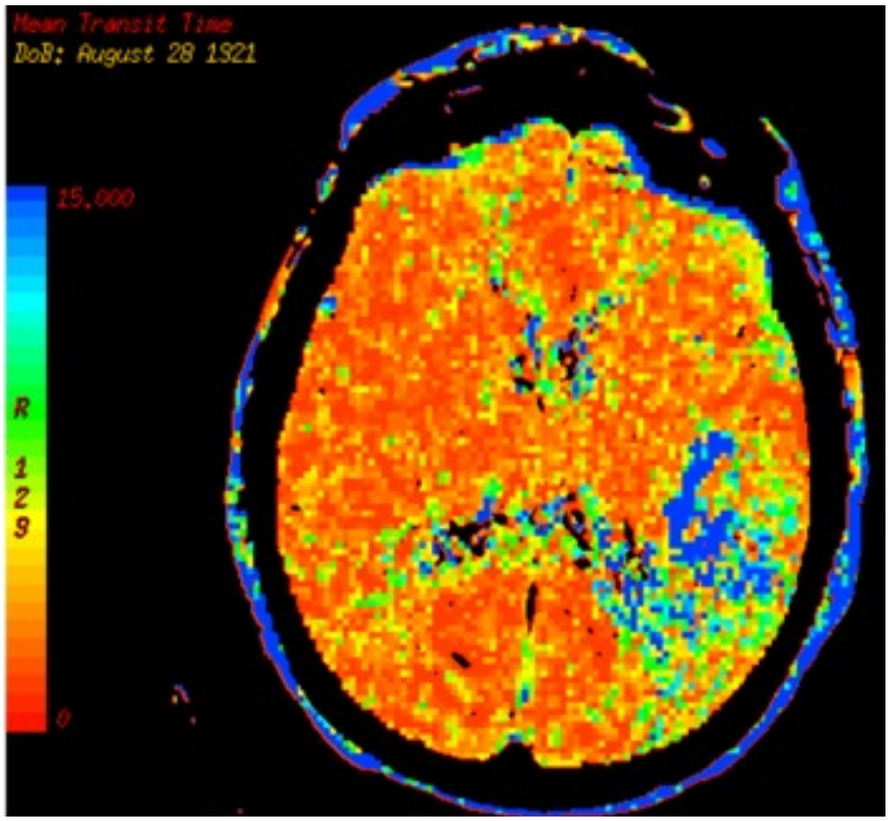
Interesting Cases

Dr. Lawrence Bub, Night Hawk Radiology

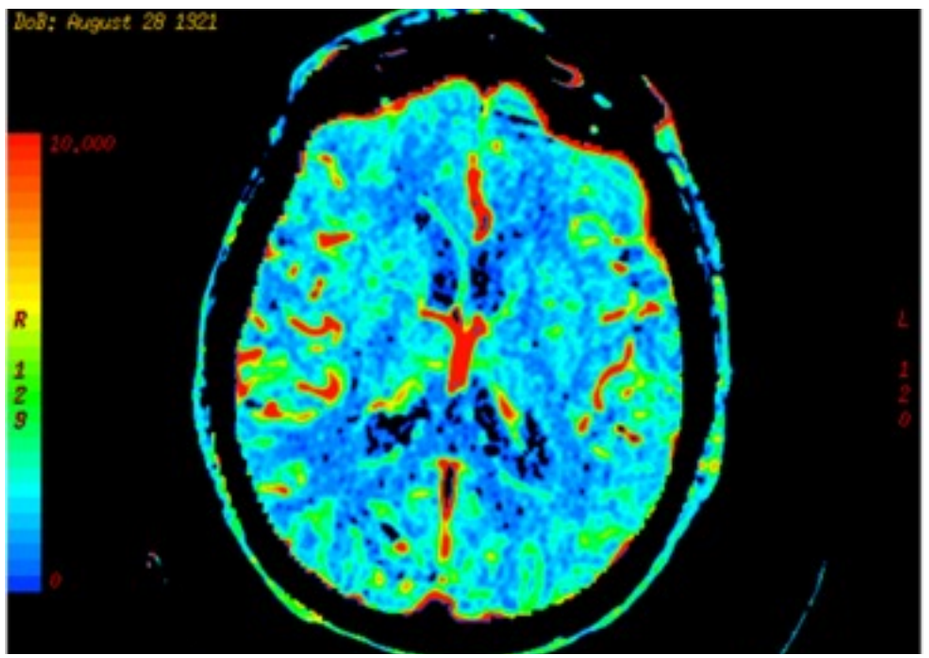
Is there a core infarct?



CBF



MTT

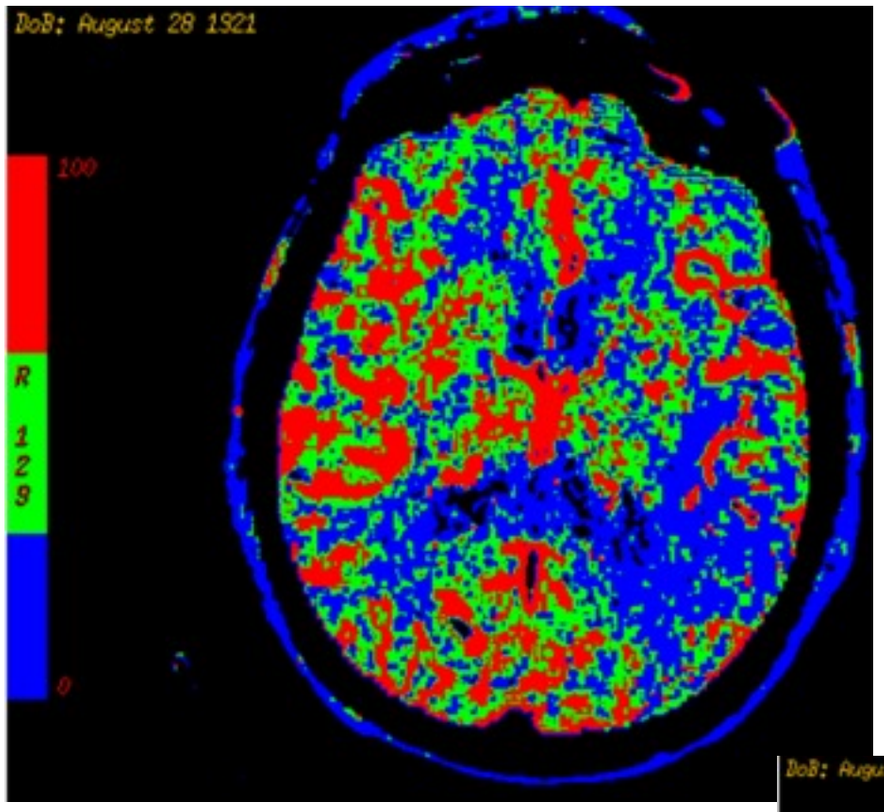


CBV

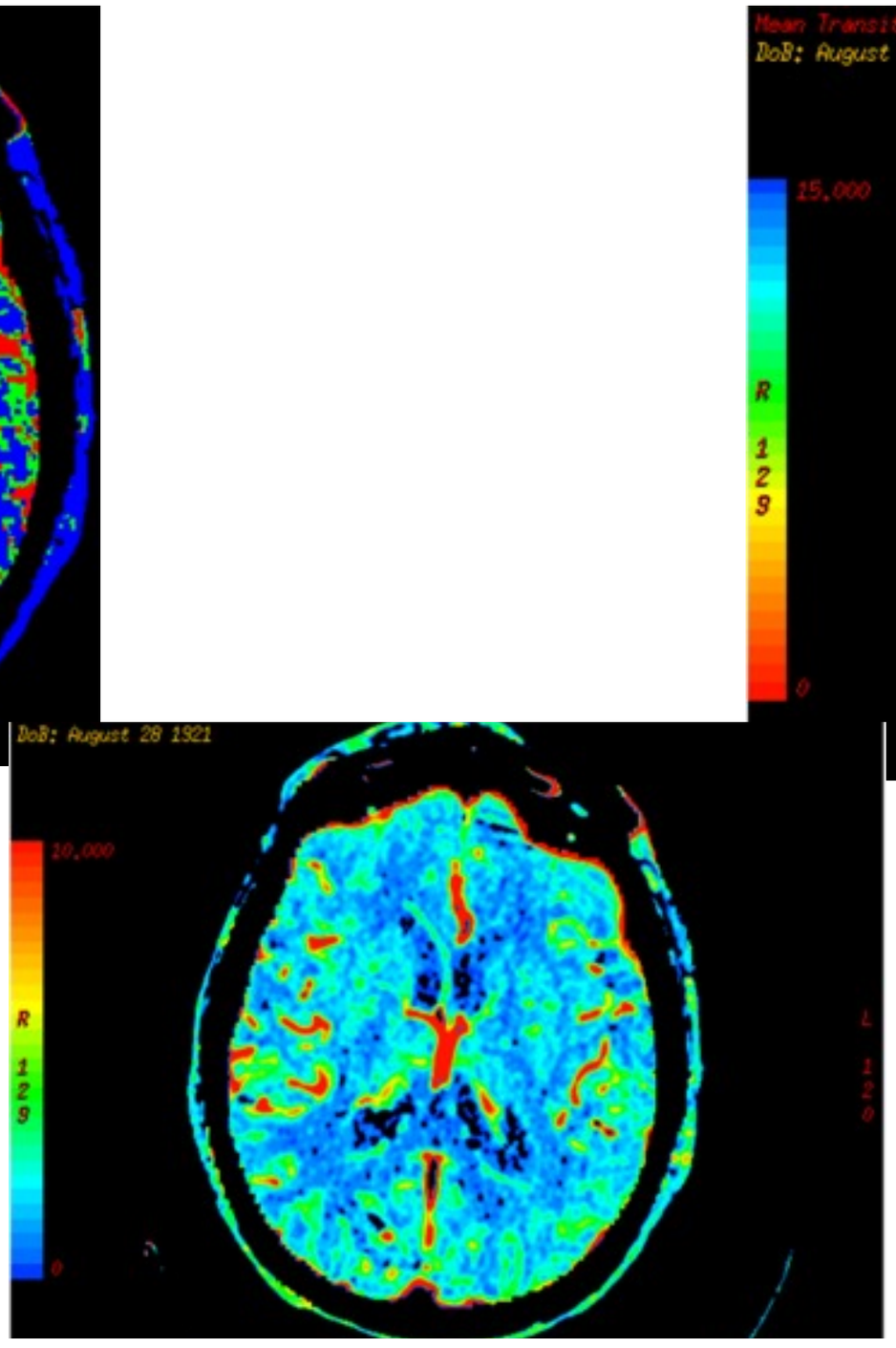
Dr. Lawrence Bub, Night Hawk Radiology

No. **Ischemia without core infarct.**

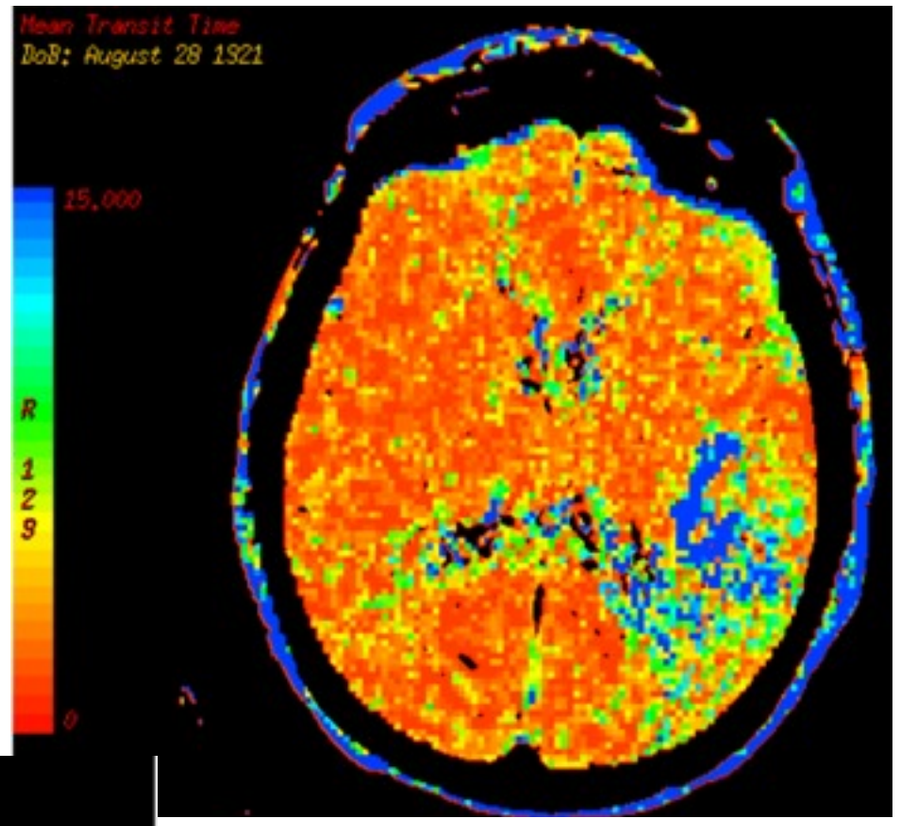
Reduced CBF and prolonged MTT, without change in CBV.



CBF



CBV



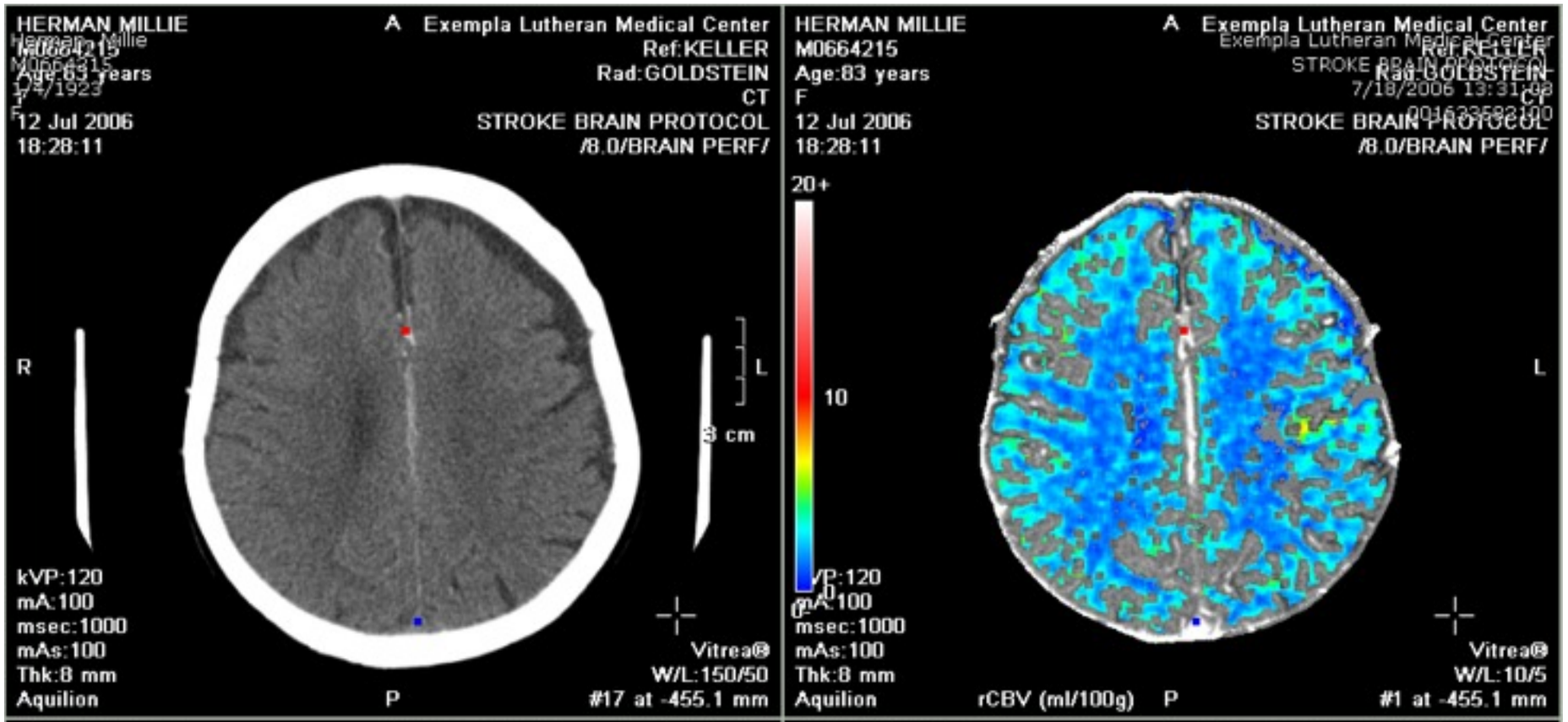
MTT

Dr. Lawrence Bub, Night Hawk Radiology

Hx:

Right hand and face weakness.

Findings?



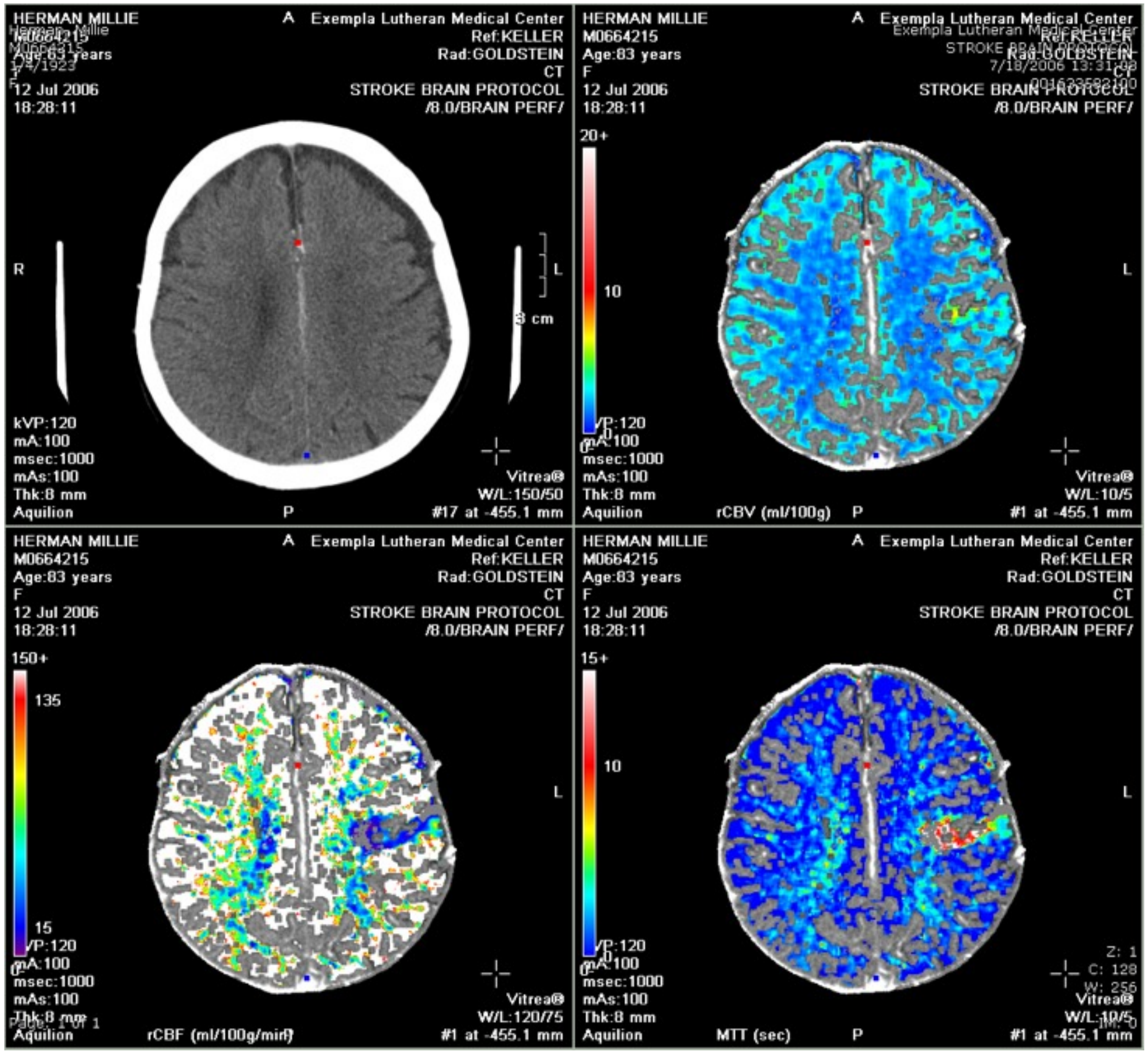
Dr. Lawrence Bub, Night Hawk Radiology

Decreased CBF

Increased MTT

Normal to slightly increased CBV in the left precentral gyrus=

Ischemia without infarct at this time.



Dr. Lawrence Bub, Night Hawk Radiology

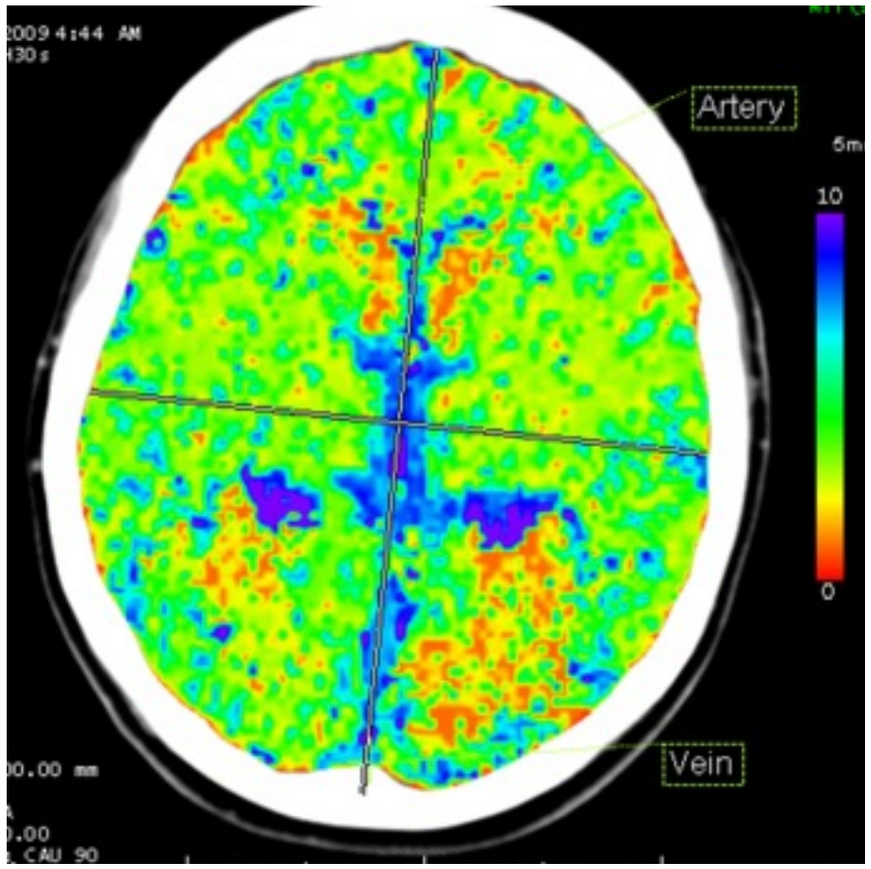
Pt had a mild deficit and was improving so no lytics were given.

Next day MRI reveals that the ischemic area went on to infarct in the same distribution.

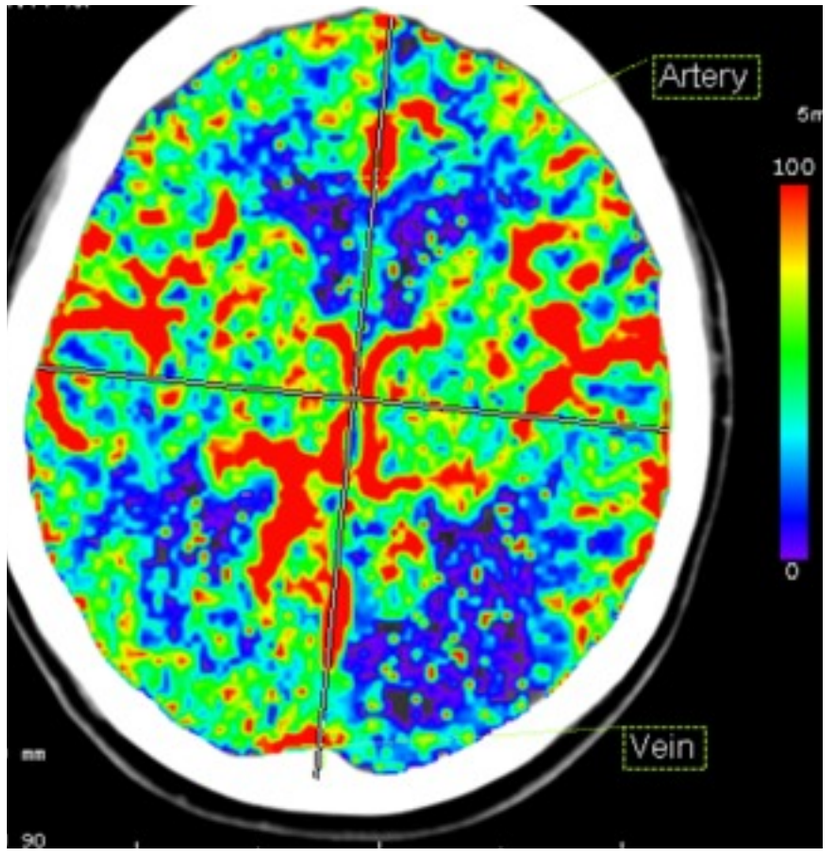
This is not uncommon, especially without tPA.

Incidentally, I rewindowed the images on the original perfusion CT, and was not able to show any areas of decreased CBV.

Dr. Lawrence Bub, Night Hawk Radiology

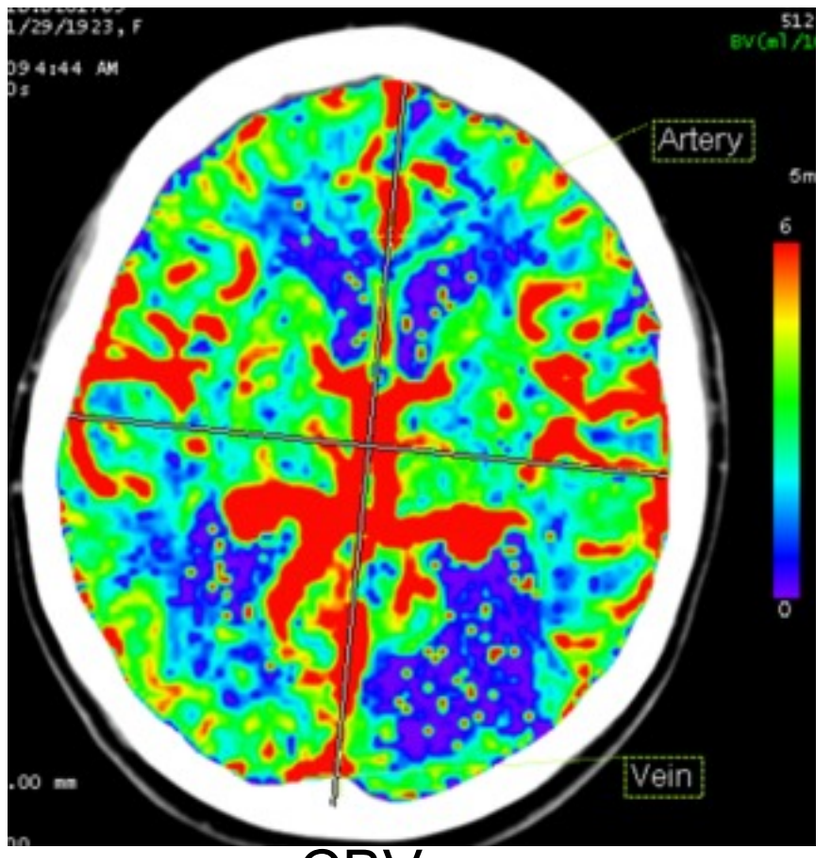


MTT



CBF

Is this an
Acute Infarct without ischemic penumbra?



CBV

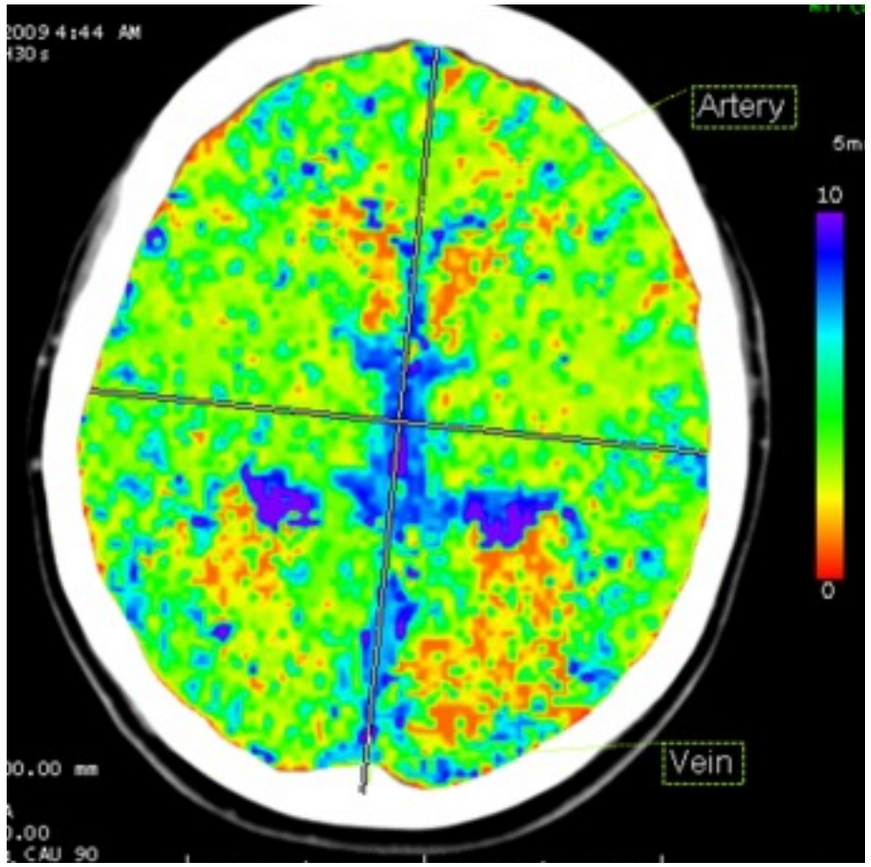
Dr. Lawrence Bub, Night Hawk Radiology

Actually, it's a chronic infarct.

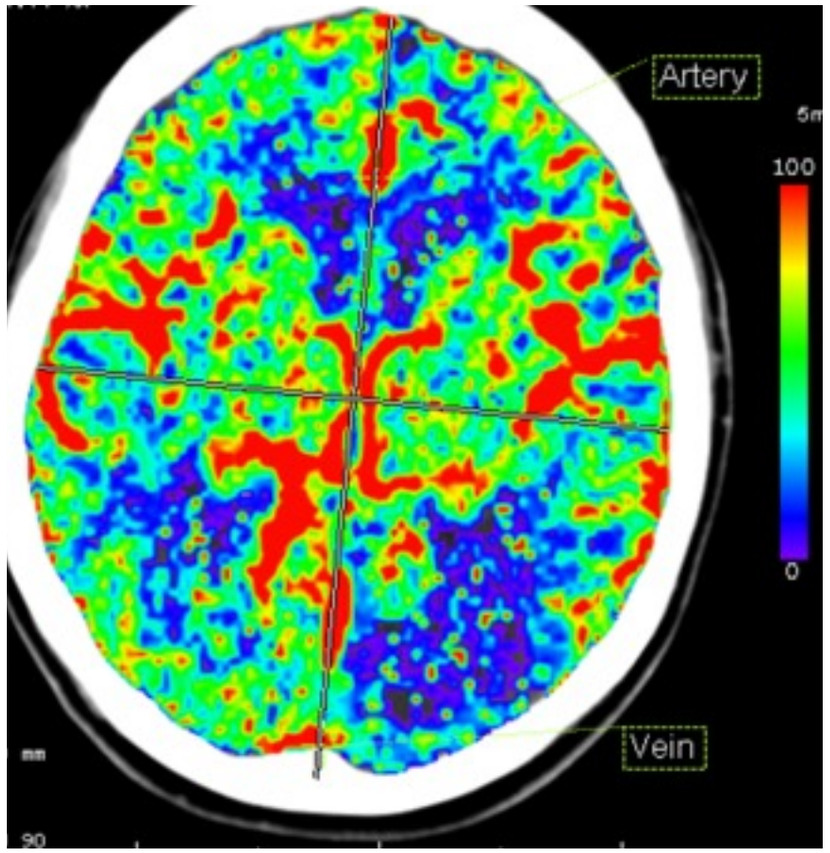
Don't forget to review the initial head CT or source images.

We cannot distinguish an acute completed infarct from a chronic infarct on CT perfusion alone.

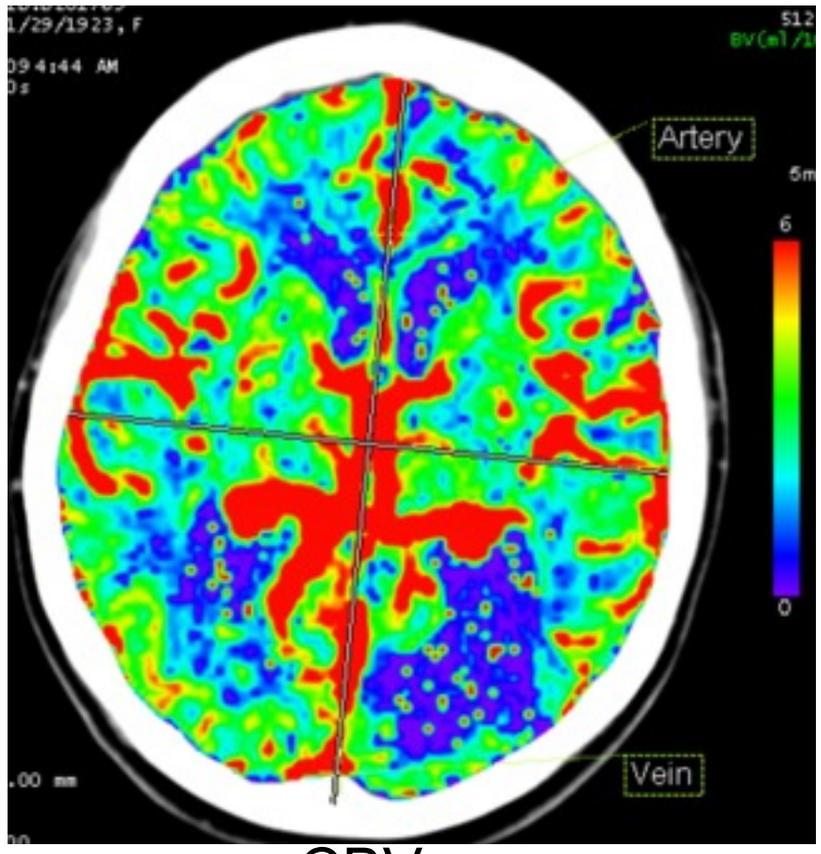
This was correctly interpreted by NRS. ☺



MTT

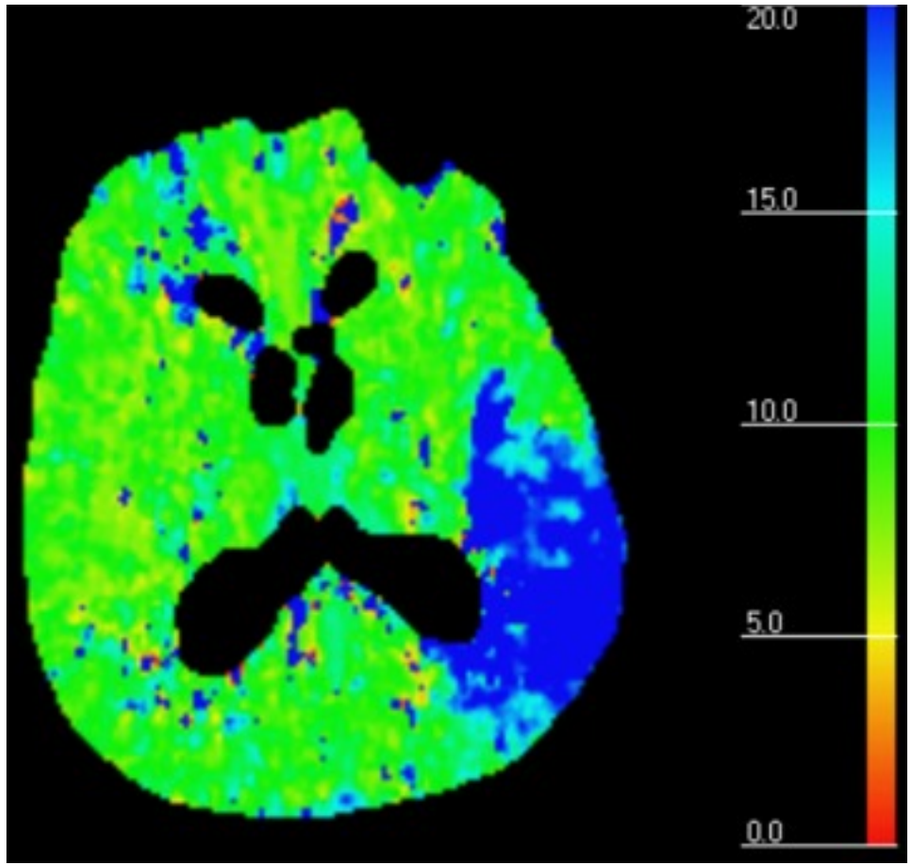


CBF



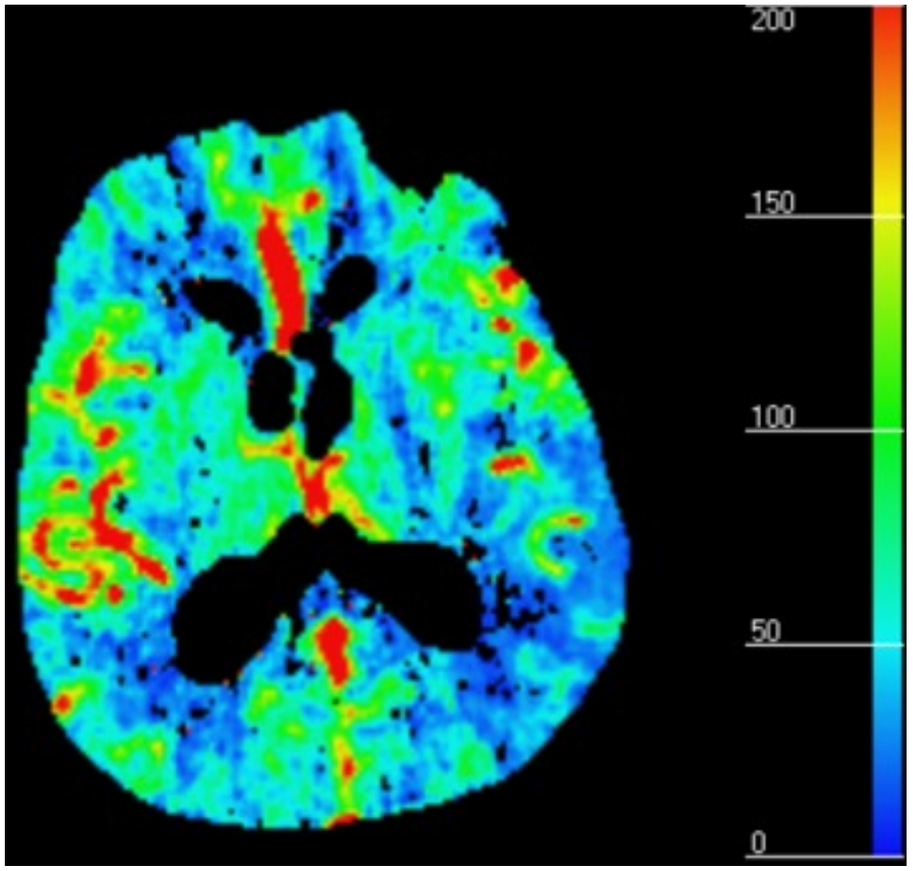
CBV

Dr. Lawrence Bub, Night Hawk Radiology



MTT

Read as 1/3 MCA territory acute infarct with ischemic penumbra?
Is this correct?



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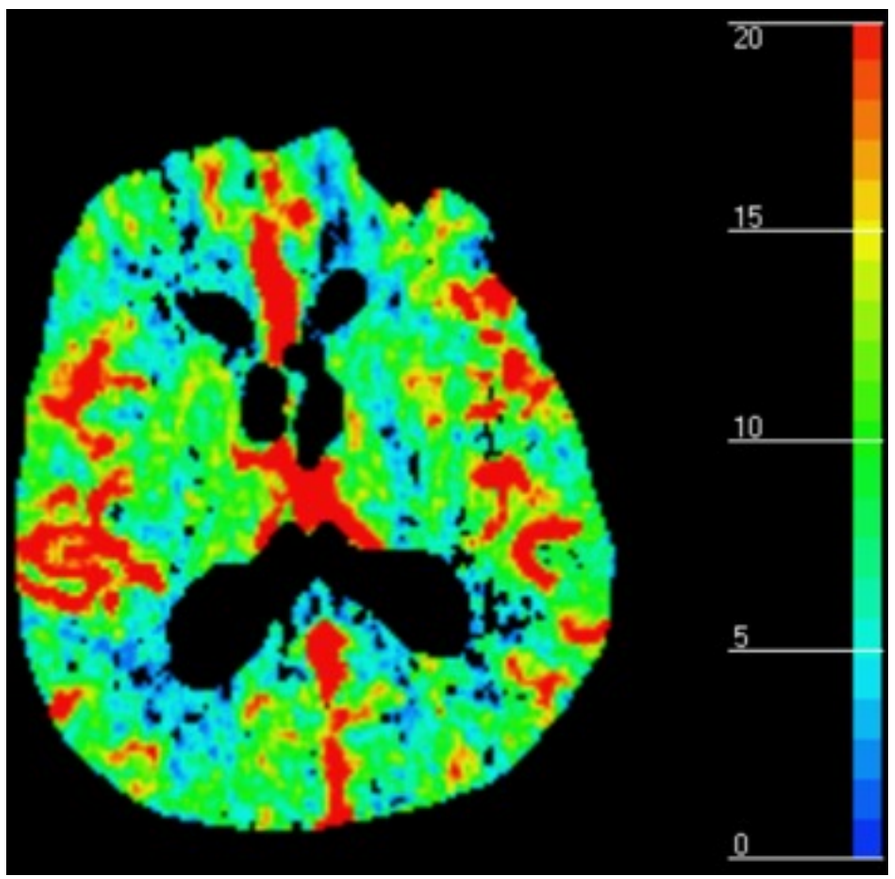

CBV

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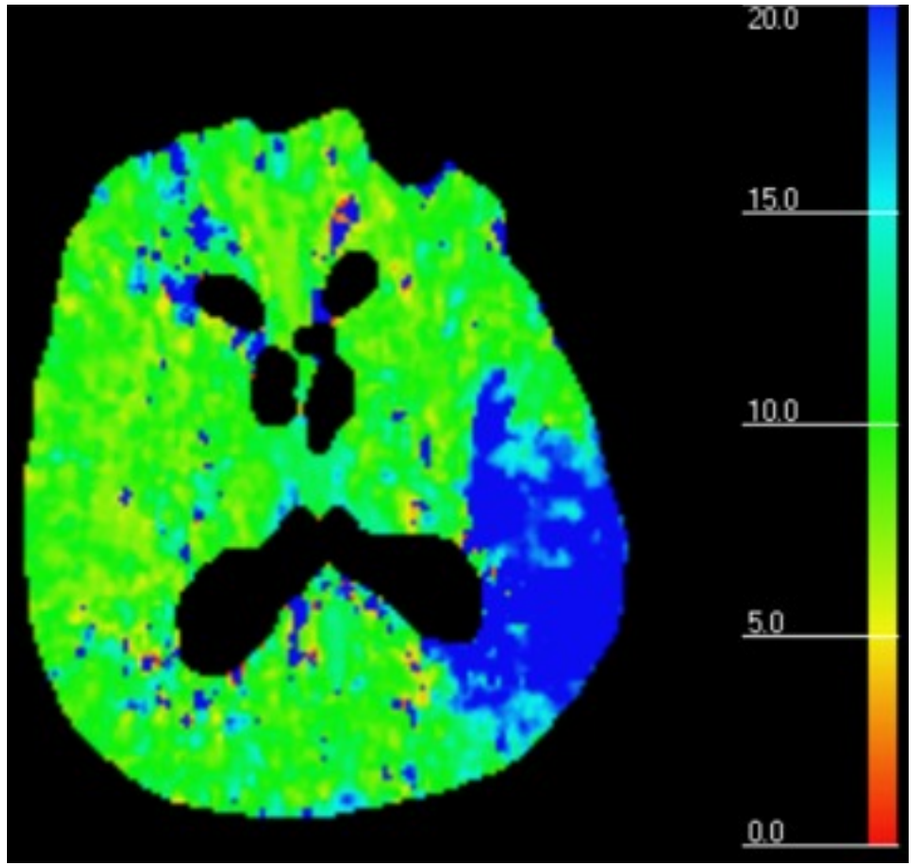

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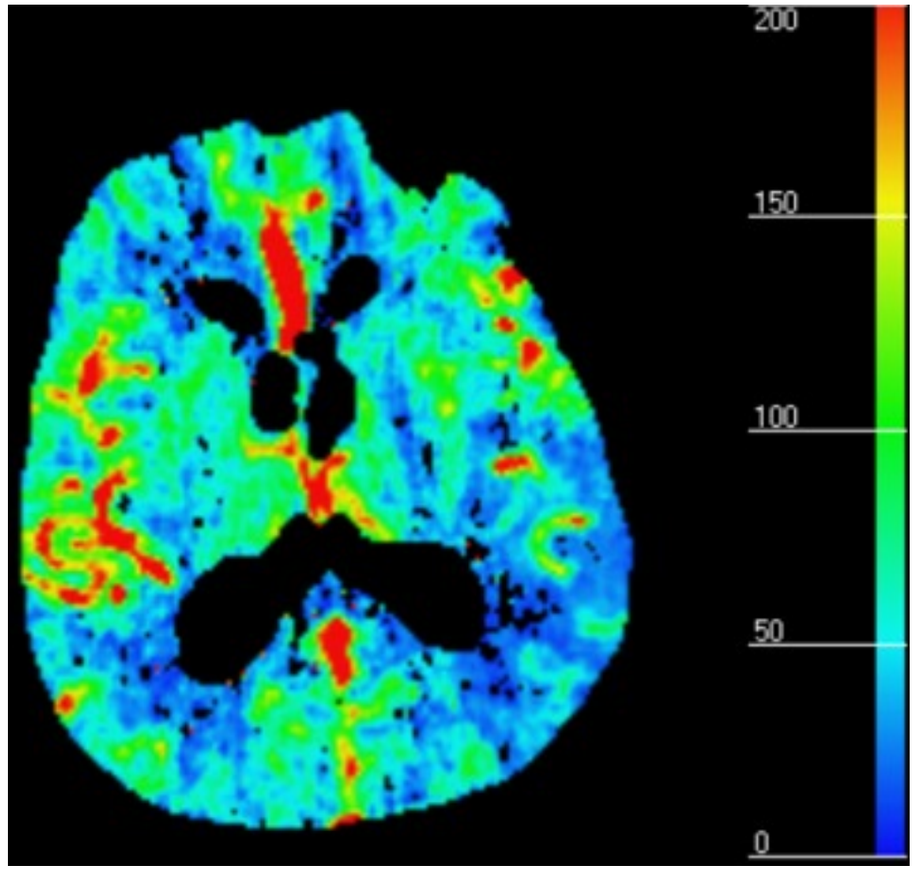
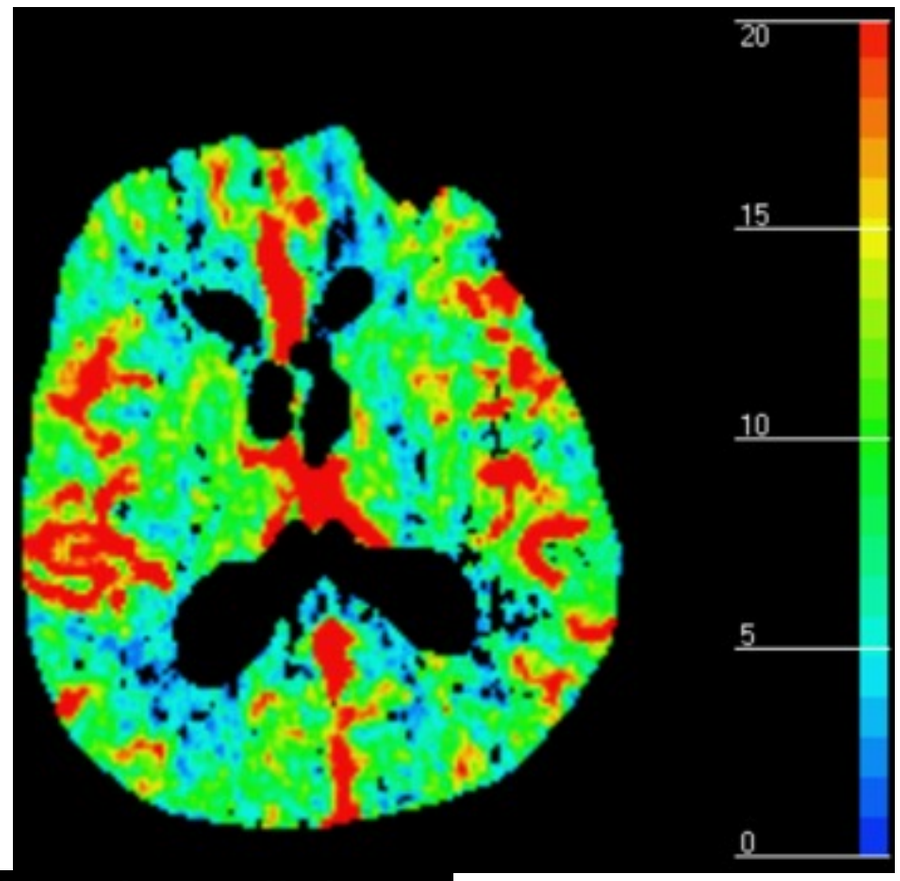


CBF

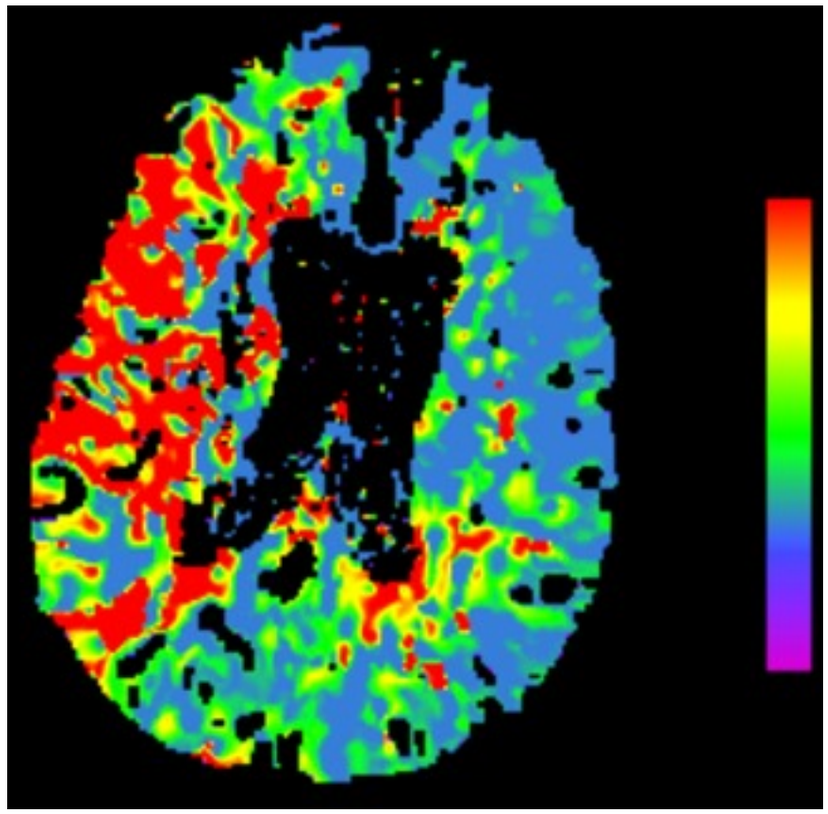
No. The correct read is:

Temporo-occipital ischemia with possible small periventricular WM infarct.

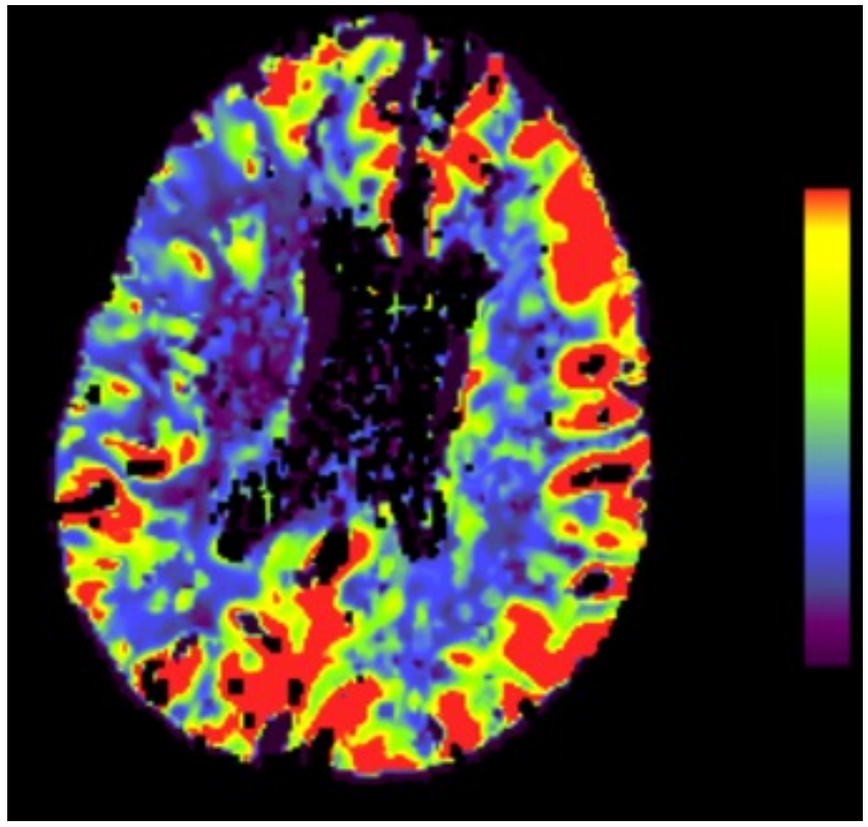


CBF

Dr. Lawrence Bub, Night Hawk Radiology



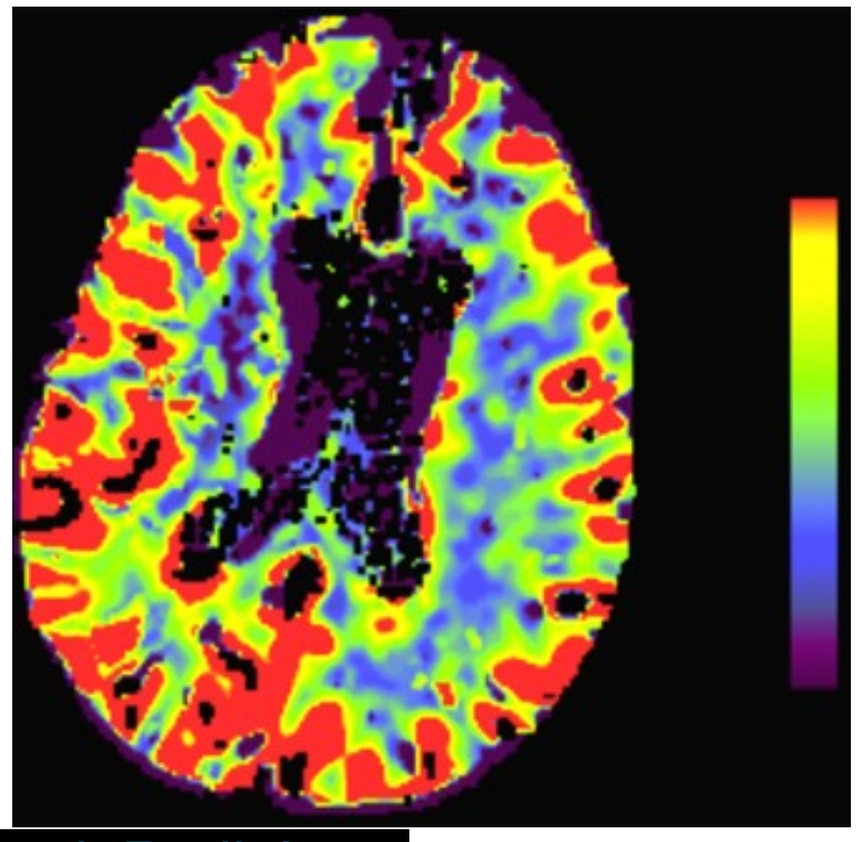
MTT



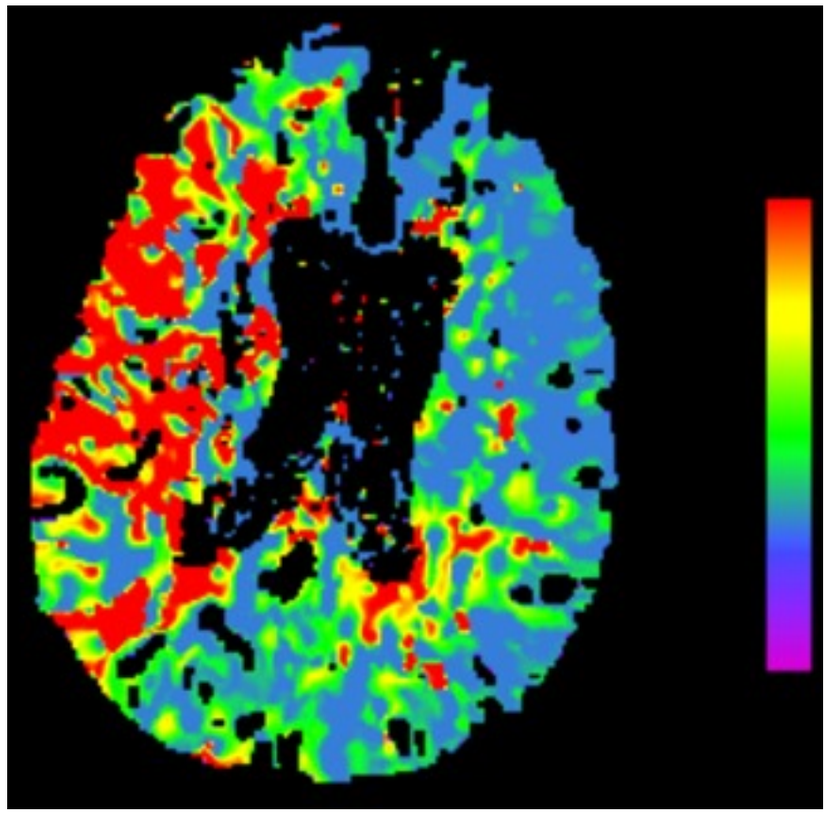
CBF

This was read as increased MTT, decreased CBF, and slightly increased CBV consistent with an acute R MCA infarct.

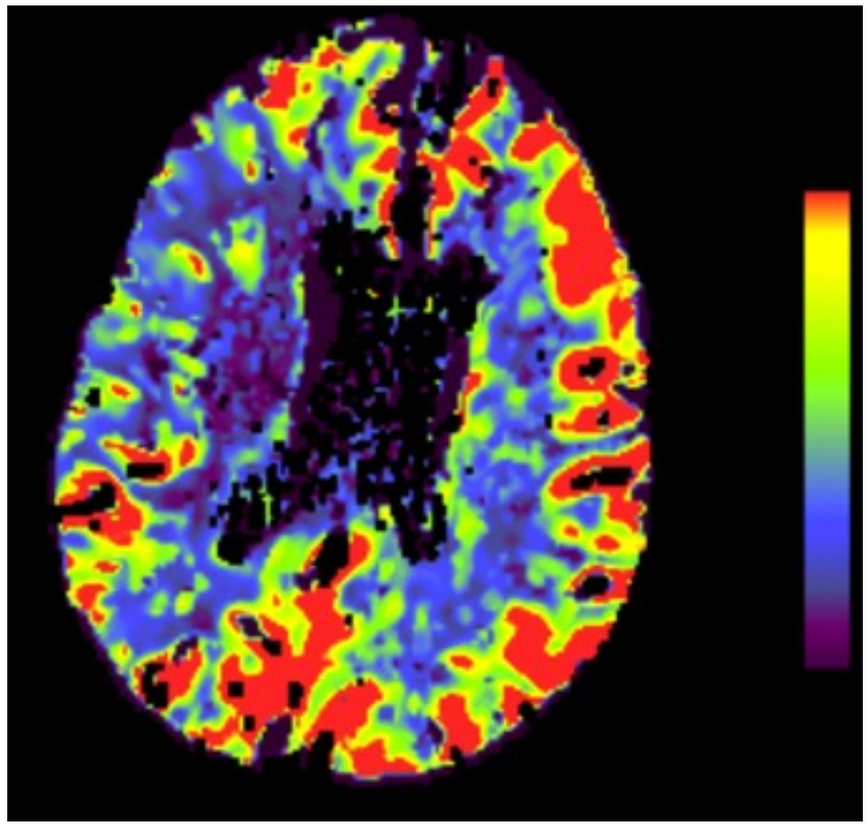
Is this statement correct?



Dr. Lawrence Bub, Night Hawk Radiology V



MTT

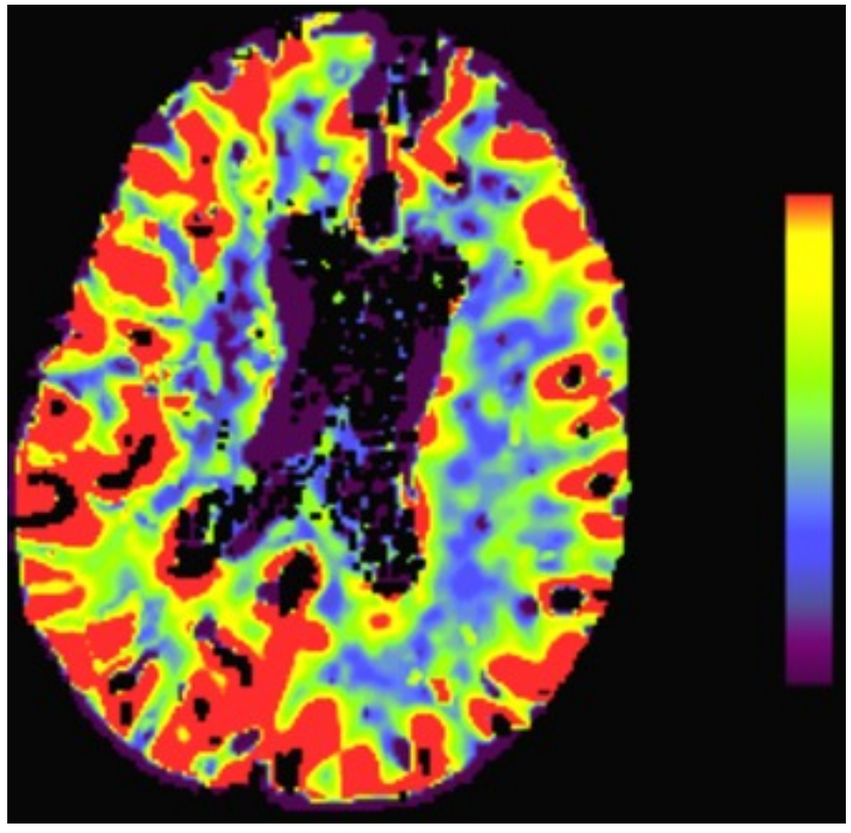


CBF

The description of the findings was correct. The conclusion was not.

We should see decreased (not increased) CBV in a core infarct. Increased CBV is c/w ischemia w/o infarct.

On close observation, there is a small area of reduced CBV in the R basal ganglia possibly indicating a small core infarct. The rest is penumbra.



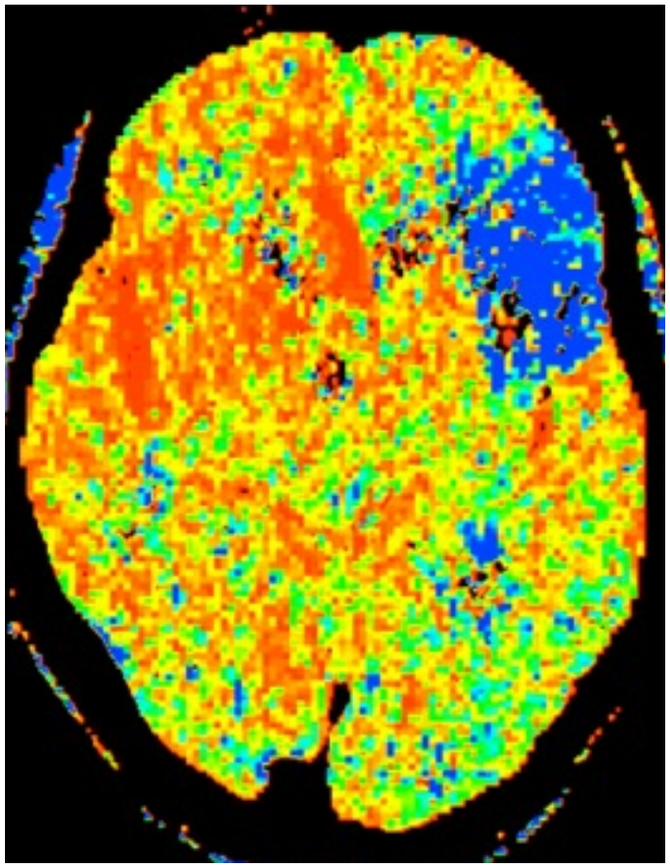
Dr. Lawrence Bub, Night Hawk Radiology

New Interesting Cases

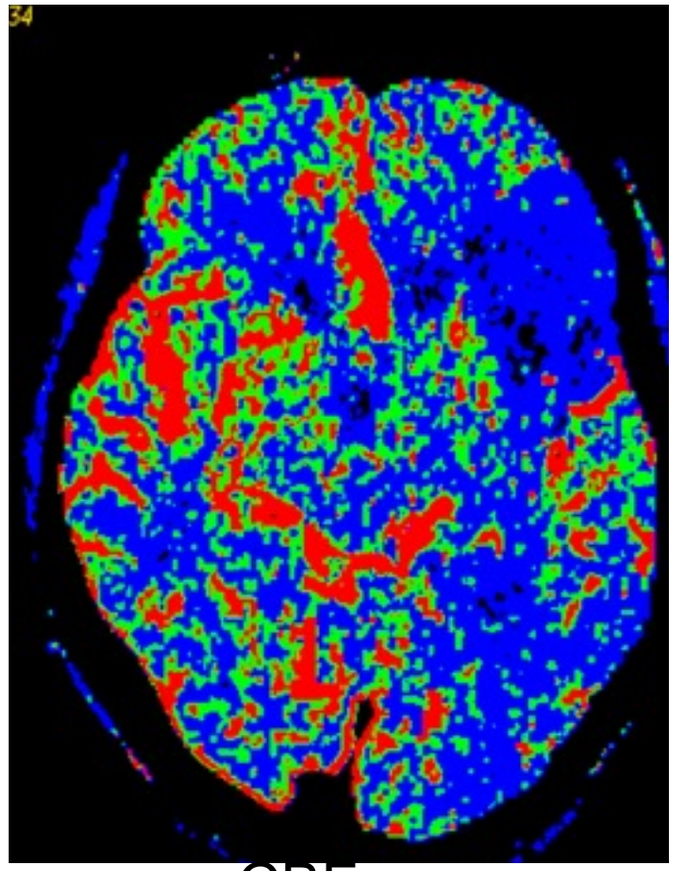
Added after 12/3/09

Dr. Lawrence Bub, Night Hawk Radiology

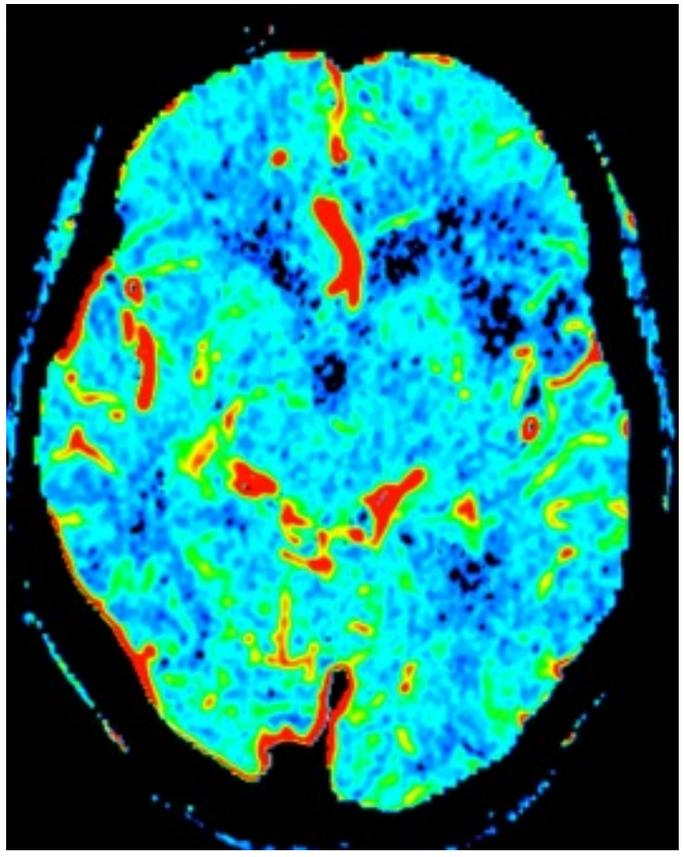
Is there a penumbra?



MTT



CBF



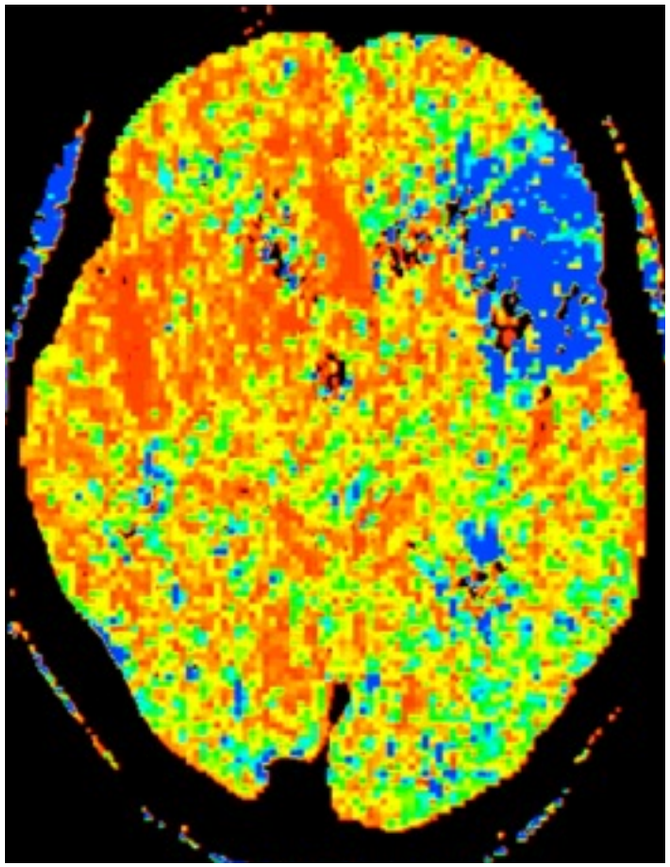
CBV

Dr. Lawrence Bub, Night Hawk Radiology

Is there a penumbra?

Yes.

There is an approximately 3cm left frontal core infarct with approximately 1cm of surrounding ischemic penumbra, and additional ischemia with a questionable minimal core infarct in the temporal and occipital lobes.



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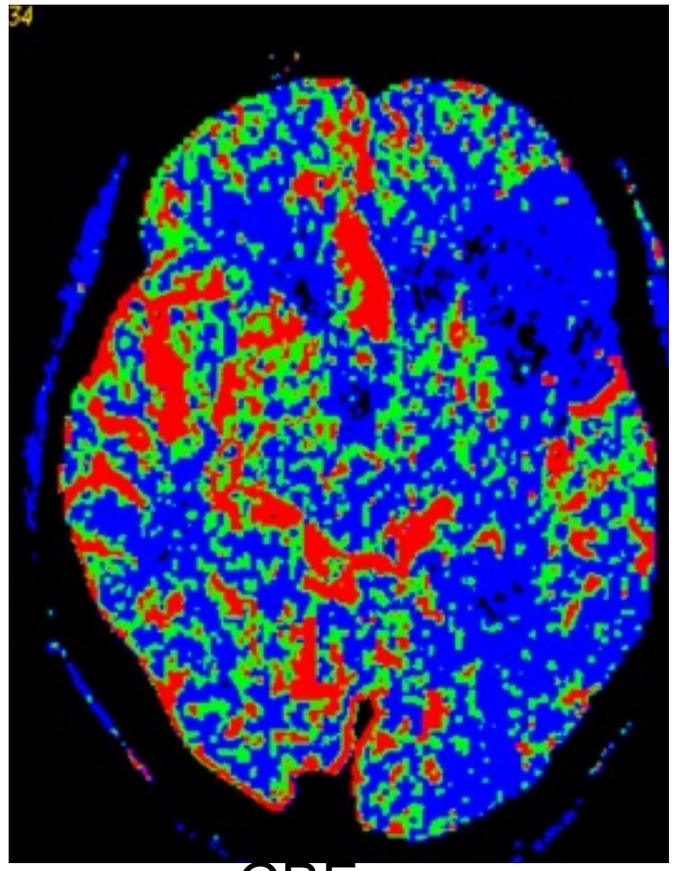
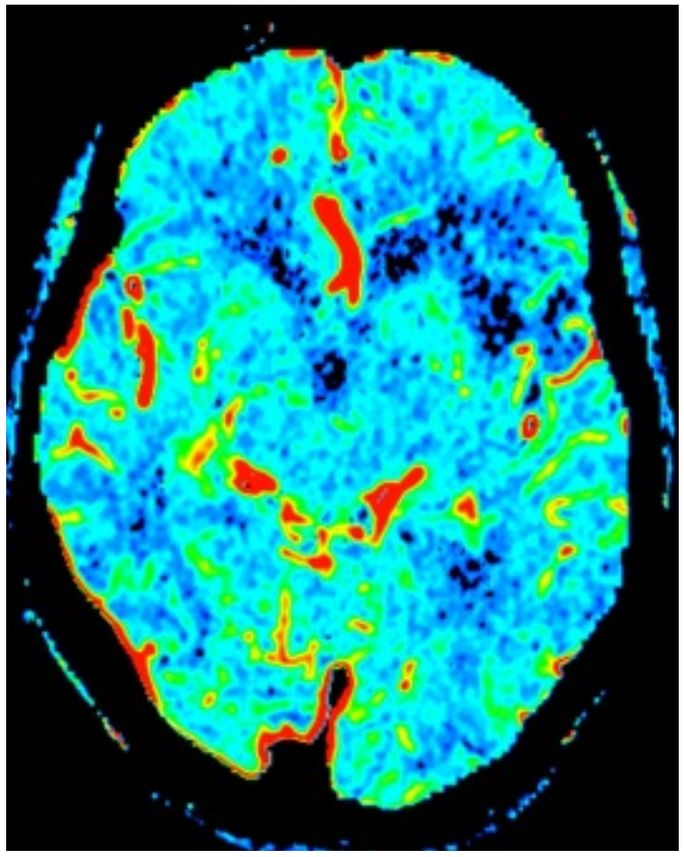


CBF



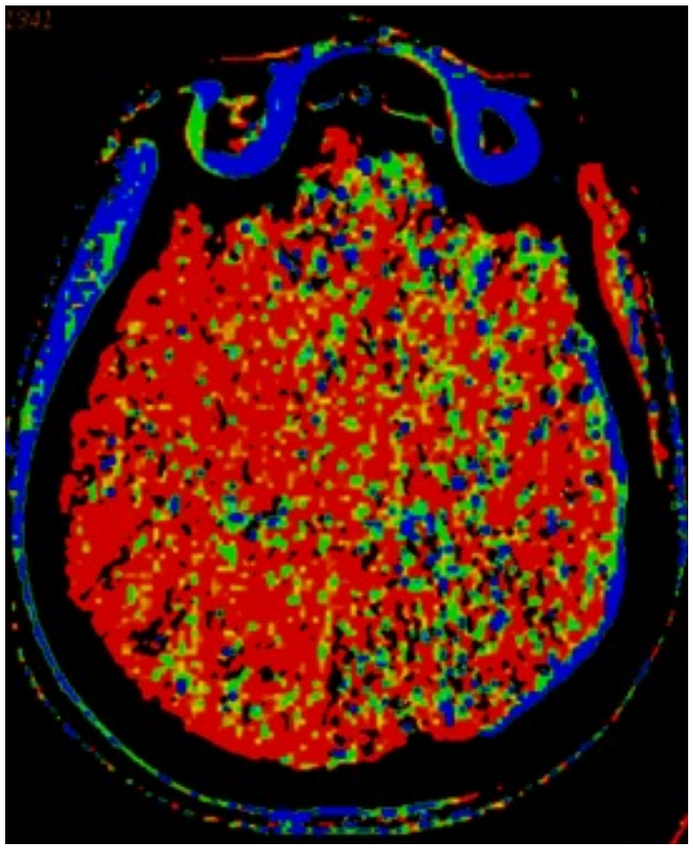
CBV

Dr. Lawrence Bub, Night Hawk Radiology

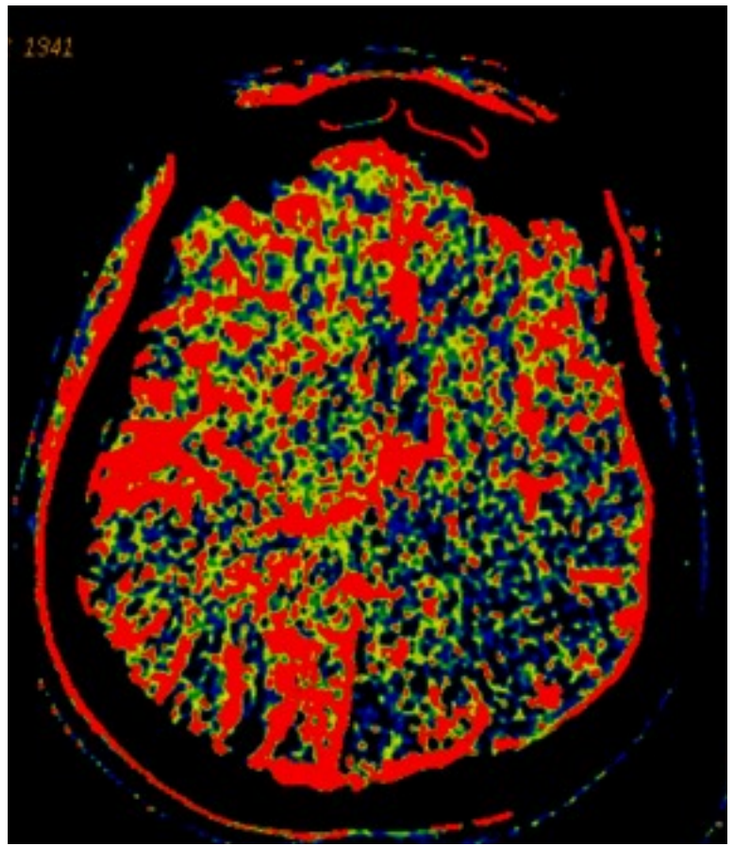
Is there an infarct?*

What is the perfusion pattern?

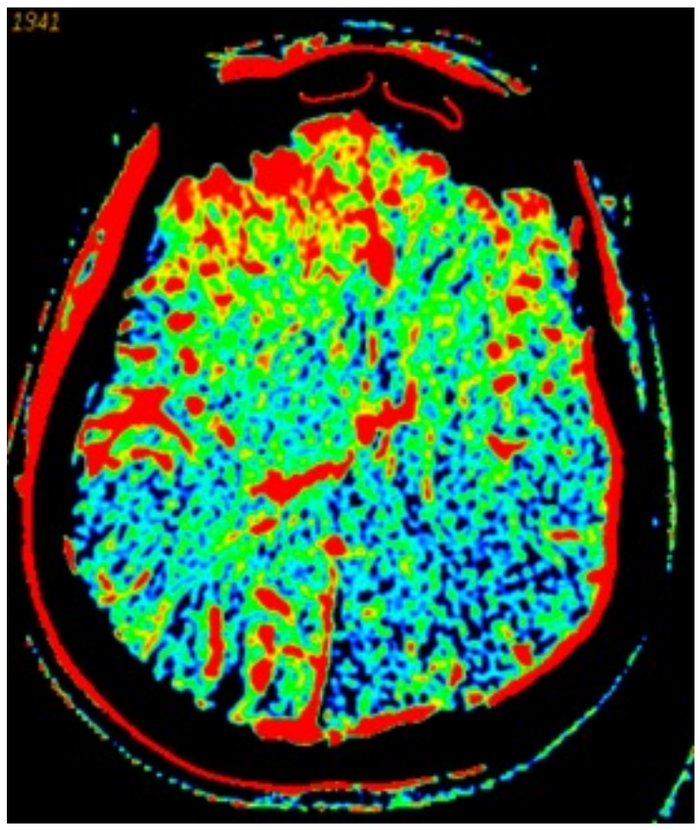
What else could this be?



MTT



CBF



CBV

*This is not an easy case.

Dr. Lawrence Bub, Night Hawk Radiology

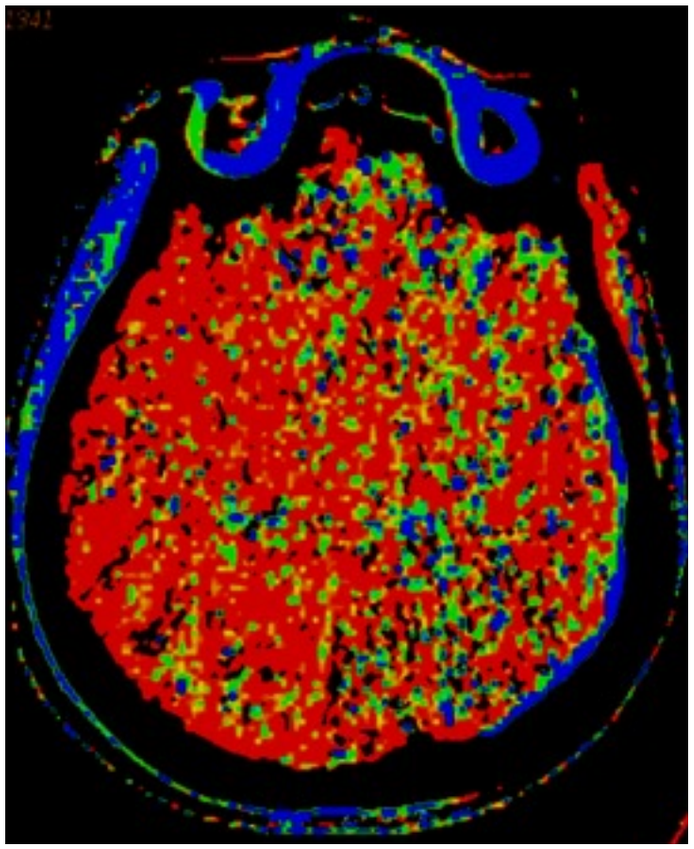
Head CT:
Ill-defined hypoattenuation and mass effect in the right frontotemporal region.

CTP:
Decreased MTT, increased CBF, and increased CBV => hyperperfusion.

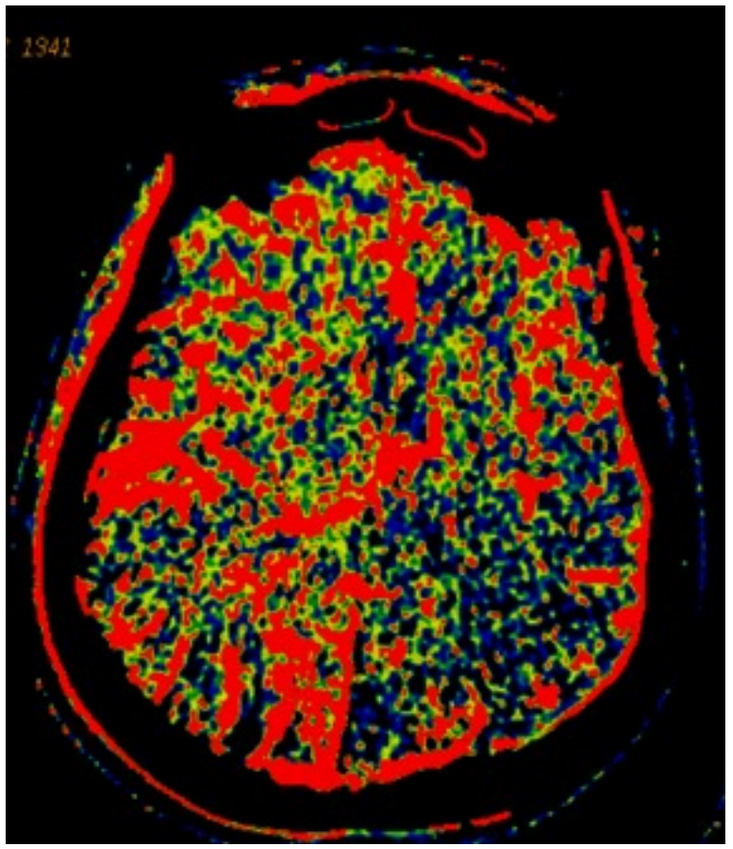
Primary Ddx in this case:
Infiltrative tumor (likely high grade) or cerebritis.

Other causes of hyperperfusion:
Trauma, status epilepticus, and reperfusion post-recanalization (luxury perfusion).

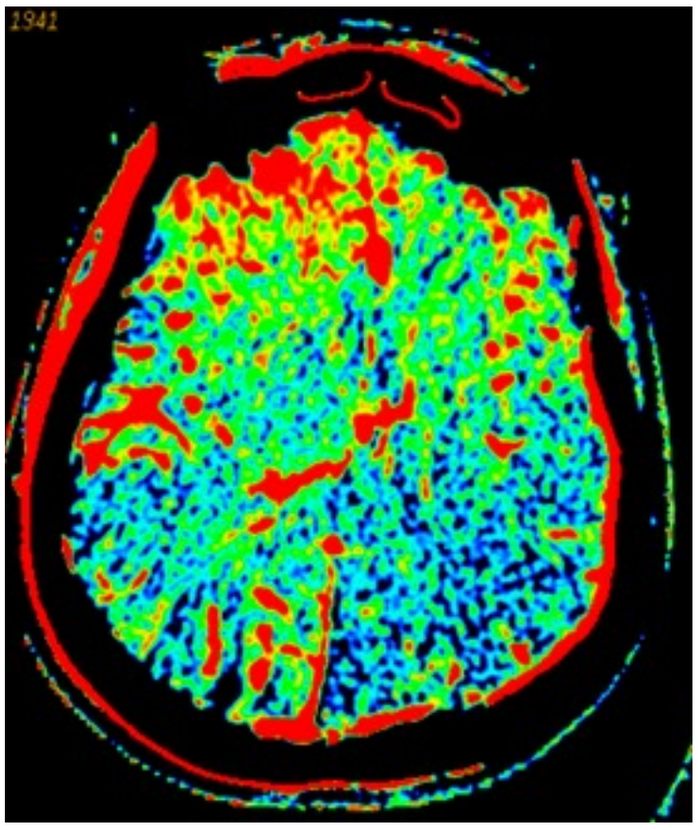
This was a glioblastoma.



MTT



CBF



CBV

Dr. Lawrence Bub, Night Hawk Radiology