Radiology 3.0

Preparing for the best of times in the worst of times

RADIOLOGY ASSOCIATES IMAGING

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Where we came from

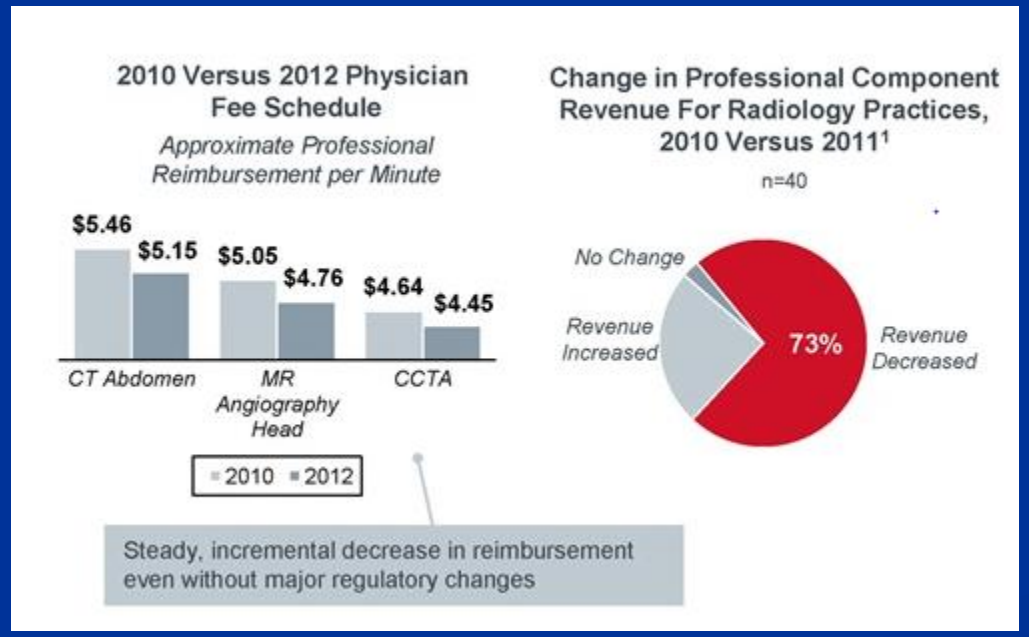
- Film based hospital practice
- Very little free standing imaging
- NO night reads; department closed at 4:30 pm
- Doctors admitted their own patients and very little decisions after 5 pm
- ER wasn't a "thing"
- Most were single small groups doing their own billing; etc

Evolution of a Radiology

- Evolved with cross sectional imaging that has replaced the physical exam
  - Patients were no longer ambushed in the OR or "explored".
- Radiologist now meant something to a Hospital and ITS medical staff
  - Diagnosis came from Radiology
  - No one went to OR without Radiology findings
- Insurers used Radiology as a "gate keeper"
- Other than night call life was good

Then Payers stepped in starting in 2003 attacking ALL components of payment

- Payment Pc = [(RVU work x GPCI work) + (RVU expense x GPCI expense) + (RVU malpractice insurance cost x GPCI malpractice insurance cost)] x conversion factor



Digital imaging; the next thing

- The GOOD
  - Significantly increased the velocity of care
  - All films could be read in a timely fashion by "right Radiologist"
  - CT, MR , IR exploded
  - Radiologist pretty close to the top of the heap and Hospitals took notice
  - Radiologist became much more efficient
- The Bad
  - EVERYBODY had access to films and wanted to read
  - Hospitals saw the revenue
- The ugly
  - Movement to for profit; non Radiologist imaging and imaging centers

The ugly (continued)

- Centers exploded; price wars started
- Radiologist either owned or were employed by centers
  - Left hospitals hanging
- Market settled down with equilibrium in work force
  - Efficiency maintained salaries with Digital and VR increasing report turn around times
- Then the “Big Money “ came to town as a works in progress

Where we are now (the worst of times)

- Mixture of hospital practices with or without OP imaging with "free standing imaging centers" competing for Insured market
  - Price is the object
- Practices with hospital contracts are bought and sold everyday to and by third parties as a commodity
- Hospital ERs are overwhelmed by volumes in Florida
  - Employee salaries going up
  - Insured patients are going down with Medicare rates a breakeven AT BEST
  - Equipment and supply cost are going up
- Radiologist market is a salaried employee expectation with projections of decreasing "match numbers"

Radiology is like surfing

YouTube

Surfing Under An Arctic Sky | Chris Burkard

Next "Big Wave" Machine learning and AI

- Artificial intelligence, machine learning
  - Will significantly improve the efficiency of the Radiologist
  - Will significantly improve the velocity of care
  - Aids in sensitivity and specificity of diagnostic test
  - Improves safety of test with real-time radiation dose and Quality monitoring

- What National Institutes of Health say
  - **Machine learning** identifies complex patterns automatically and helps **Radiologists** make intelligent decisions on **radiology** data such as conventional **radiographs**, CT, MRI, and PET images and **radiology** reports

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artificial intelligence in medicine

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Healthcare Artificial Intelligence (AI) Market Grow at a Steady CAGR of 39.7% by 2026 | IBM, iCarbonX, Insilico Medicine, Inc.

Deep Medicine: How AI will improve self-care

By **Ben Dickson** - September 4, 2019

What excites you the most about AI in medical imaging right now?

Brian Baker: The most exciting aspect of AI in medical imaging is that we are starting to see a real impact on patients. We are beyond theory and academic papers and are implementing substantial, results-driven solutions.

How AI can predict fatal heart attacks years in advance

Michael Walter | *September 05, 2019* | *Artificial Intelligence*

RadNet partners with Silicon Valley AI vendor to dramatically boost breast cancer care

AI rivals radiologists in finding brain hemorrhages

AI predicts when breast lesions will progress to invasive cancer

Battling helplessness: Experts urge radiologists not to sit on the sideline as AI takes hold

Company tries image crowdsourcing to speed up AI's proliferation in radiology

AI can predict MR sequence types, saving providers time

Radiomics model beats radiologists at categorizing BI-RADS 4 lesions

Radiomics model beats radiologists at categorizing BI-RADS 4 lesions

AI helps radiologists spot lung tumors, drop false positives

AI predicts when breast lesions will progress to invasive cancer

What Has Artificial Intelligence Done for Radiology Lately?

Julie Ritzer Ross* / *August 09, 2019* / *AI & Machine Learning

- Fractures on plain films; studies that need more attention can be prioritized for quicker turnaround
- Alzheimer's PET scan; magnifies subtle changes compared to reference data base
- Prostate MRI; again magnifies subtle difference in signal intensity
- Mammography; R2 checker on steroids with tomosynthesis
- Automated dose reduction base on body habitus
- Faster MR scanning; "We've accelerated these scans by a factor of six compared to standard MRI scans, and radiologists cannot distinguish between the images from both types of scans"
- M Model application the screens and corrects incongruent radiology reports

What Industry says…

- Order scheduling and patient screening
  - Patient throughput efficiency with self scheduling apps; old film prefetching, Ins preauth
- Image acquisition
  - Faster exam times in MR, CT with AI motion correction, "image fill in"
- Automated detection of findings (CAD programs in breast, lung, PET; etc)
- Automated interpretation of findings; Pneumothorax and intracranial hemorrhage so far
- Intelligent machine driven post processing reducing need for 3D tech; etc
- Radiation dose monitoring
- Smart reporting that edits VR reports for incongruent findings

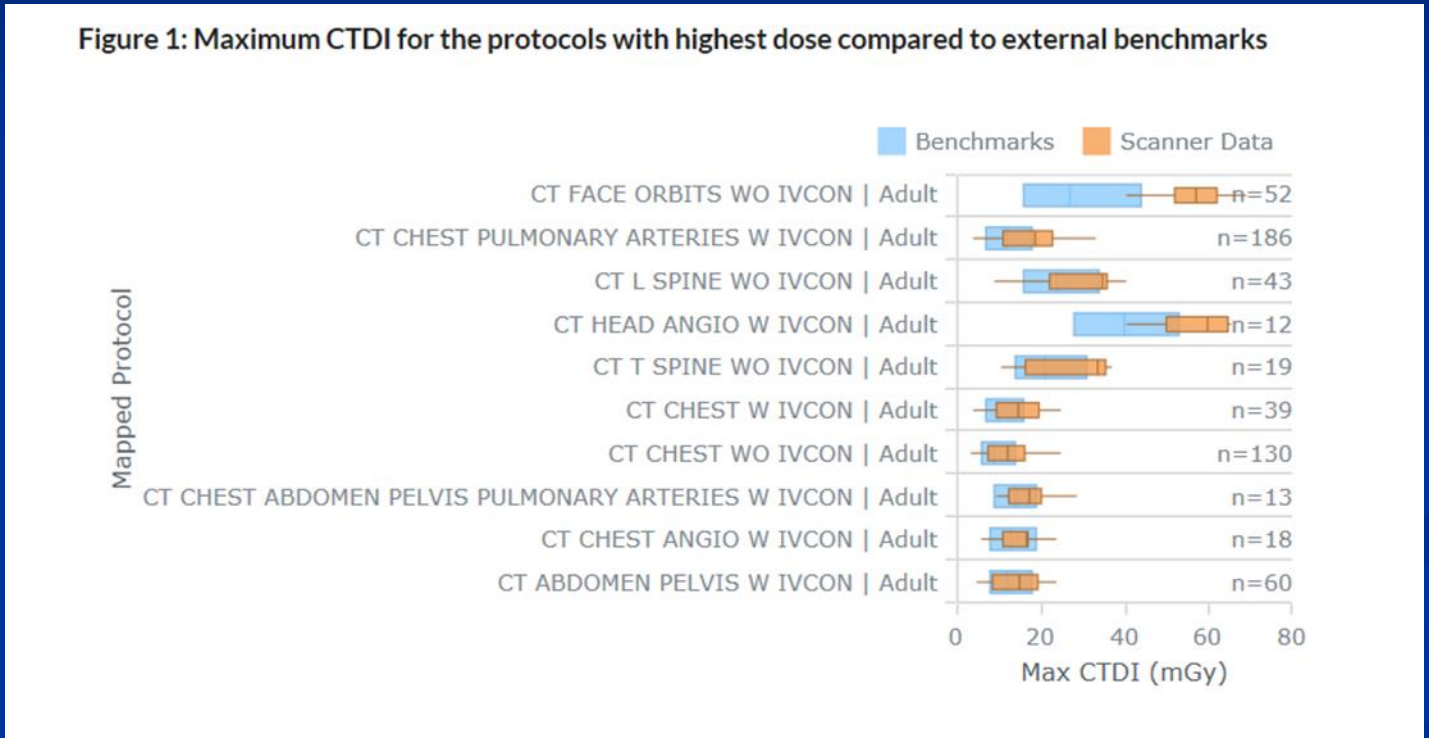
What I think…. Best yet to come

- Make routine work flow more efficient
- Real-time diagnostic interpretation support
  - INCREASE conspicuity of subtle finding
- Accurate, correct reporting in a shorter amount of time
- BEST OF ALL; Minimizes search time for findings

MY GOAL

- All CASES I READ will be reviewed by Machine learning/ Artificial Intelligence
- Less search time detecting abnormality and more time interpreting findings with information from lab and pathology incorporated
- Want my primary job to be working with the data, assimilating information, conjuring up a more accurate diagnosis, and providing valuable input in complex clinical cases
  - Human brain functions as a learning data integrator/processor; making "sense" out of complex inputs
- AI will complement my practice; not replace me
- At end of the day goal is better, safer, patient care at a faster velocity

Radiation Dose Monitoring

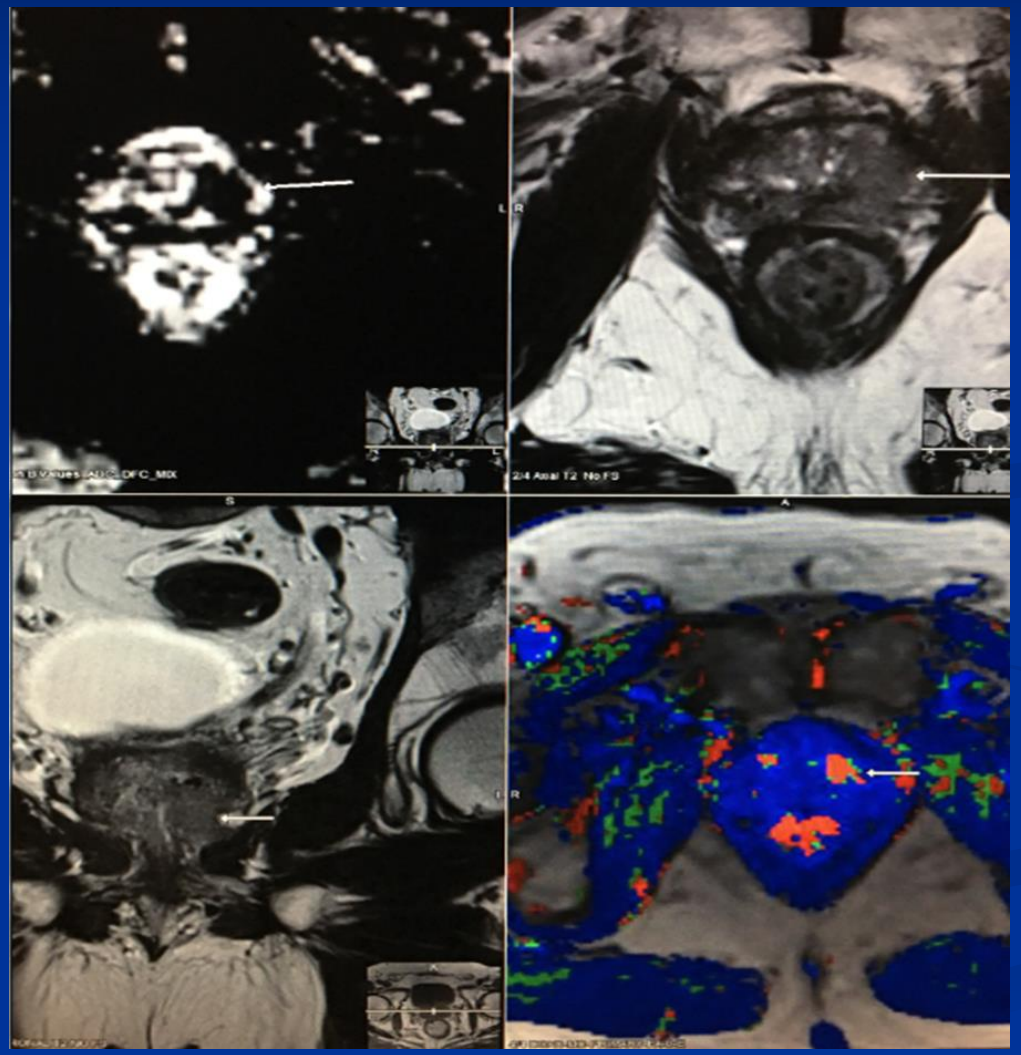


Radiation Dose already monitored by Machine Learning and automatically ADJUSTED

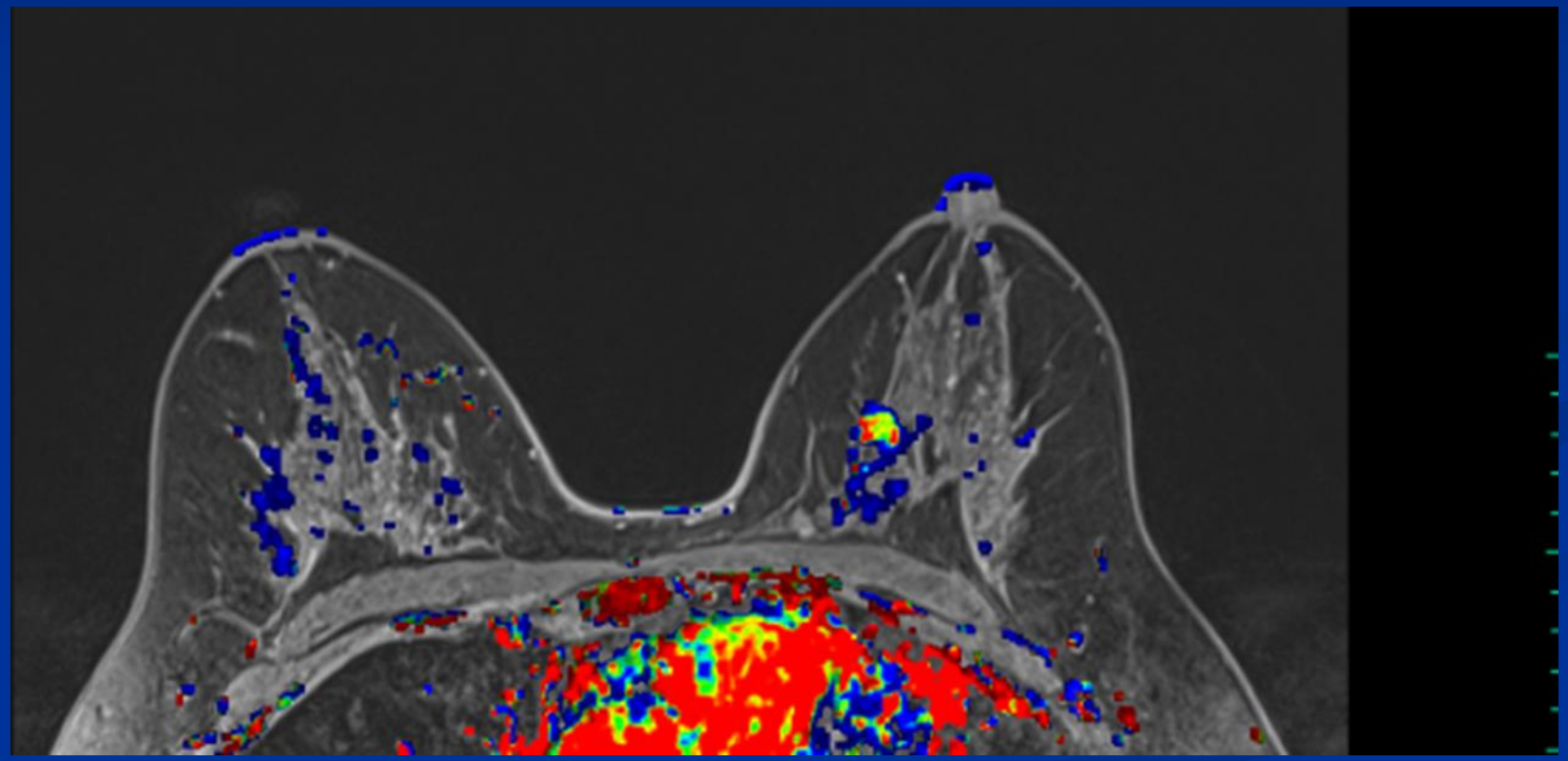
Prostate Cancer

A new technique combining radiomics and machine learning can predict the aggressiveness of prostate cancer (PCa), sparing patients from invasive biopsy, according to a study published Sept. 5 in *Clinical Radiology*.

Prostate Cancer Prediction

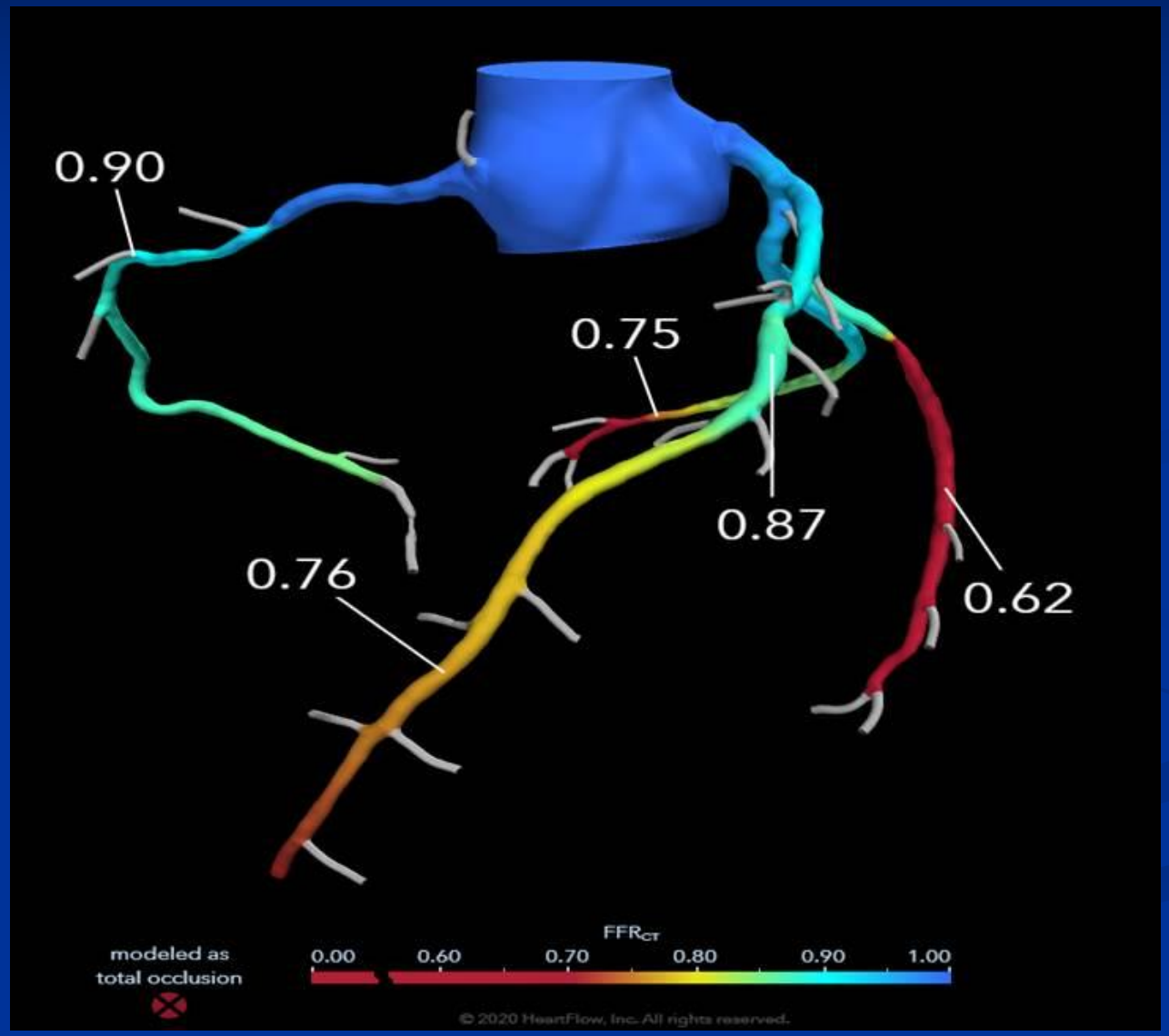


Breast Cancer Prediction



Coronary blood flow derived from CT scan of the heart

31 yo ER patient, equivocal clinical findings



Cath report

Help

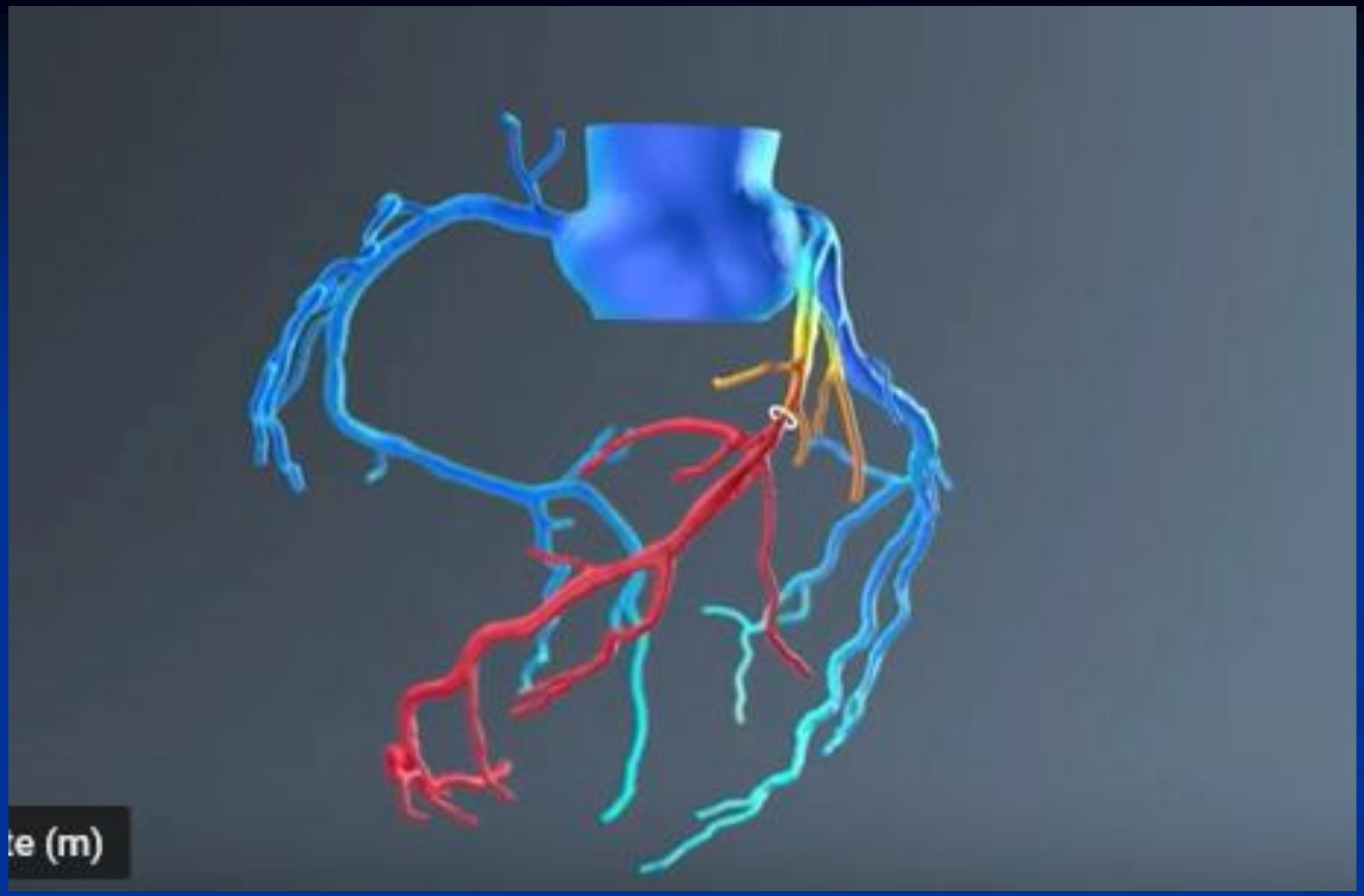
Mode Delay

Impressions:

1. Significant CAD of the distal left circumflex
2. Moderate disease of the first OM and mid RCA
3. Normal LV function
4. Successful PCI of distal left circumflex

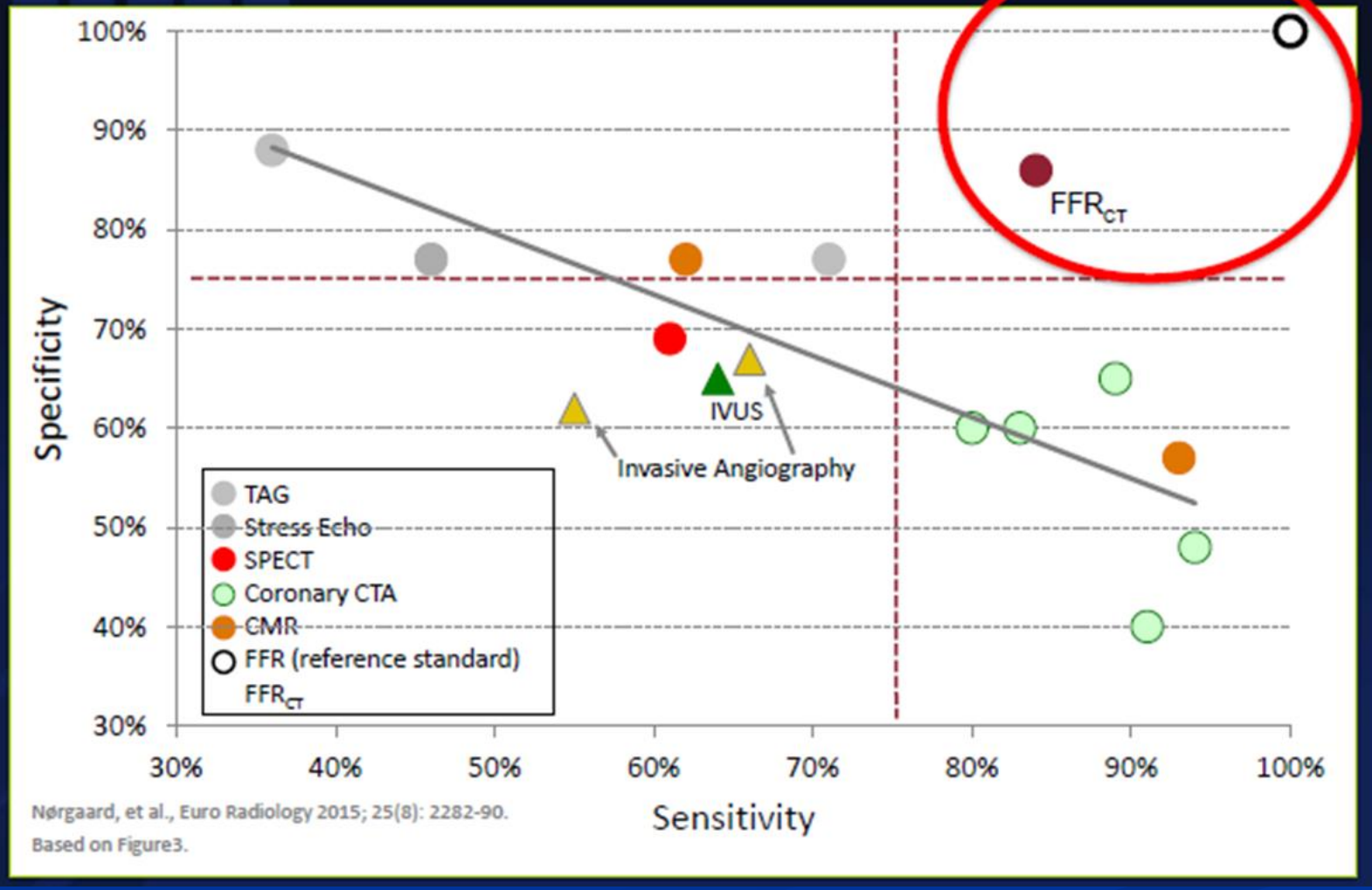
history of illicit substance abuse.

5. Did spend greater than 10 minutes previously couns



Pre-procedure planning by AI

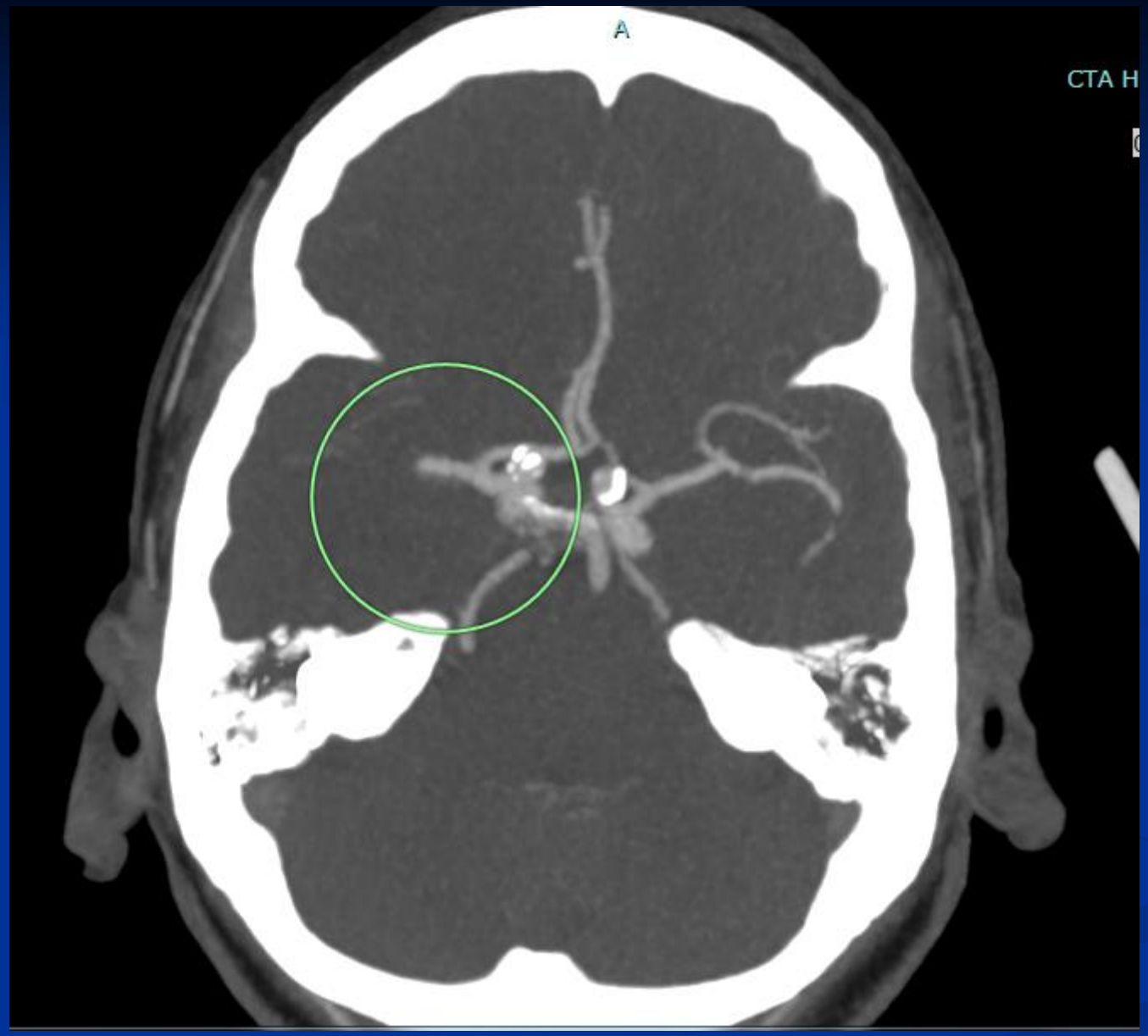
How good is Coronary CTA + FFR_{CT}?



Nørgaard, et al., Euro Radiology 2015; 25(8): 2282-90.
Based on Figure3.

“RAPID” CT Perfusion scan for Stroke

- Rapid CT angiogram of head and neck is preformed
- MUST be preformed on latest generation CT scanner
- Images sent to California and “Crunched” with a super computer
- Reconstructed images are returned in less than 5 minutes
- Uses artificial intelligence to rapid predict who will benefit from intra- arterial clot extraction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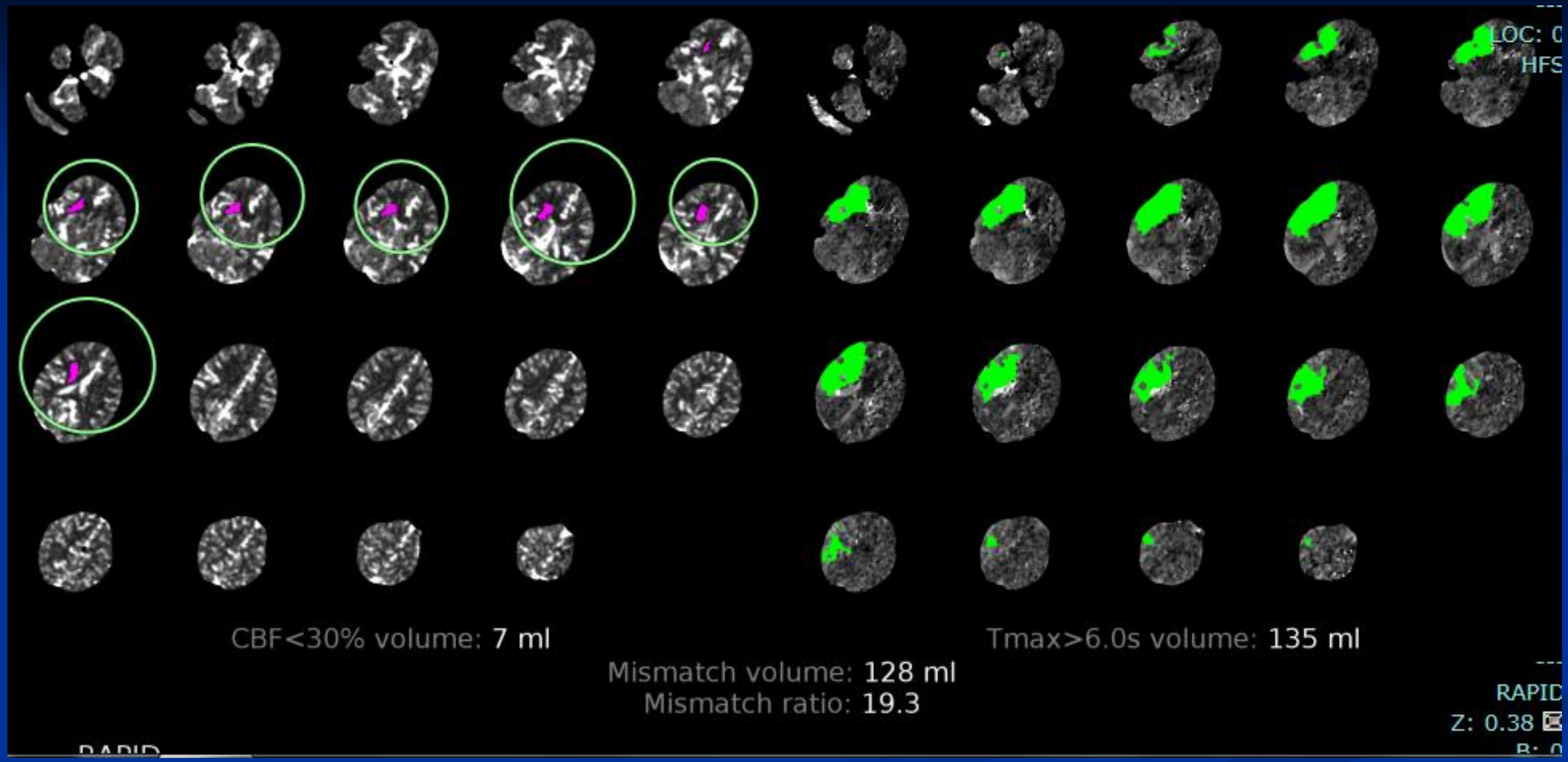
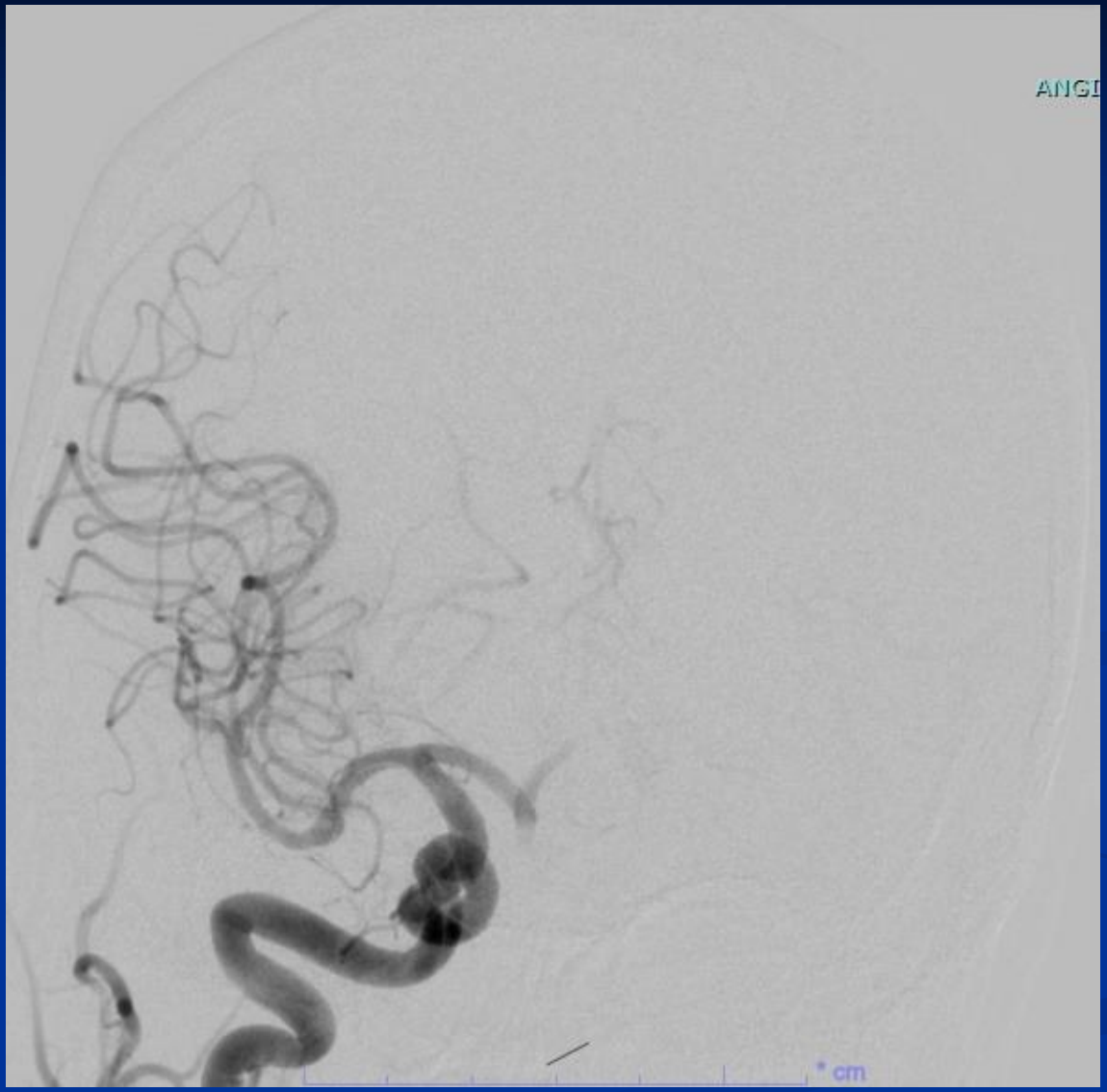
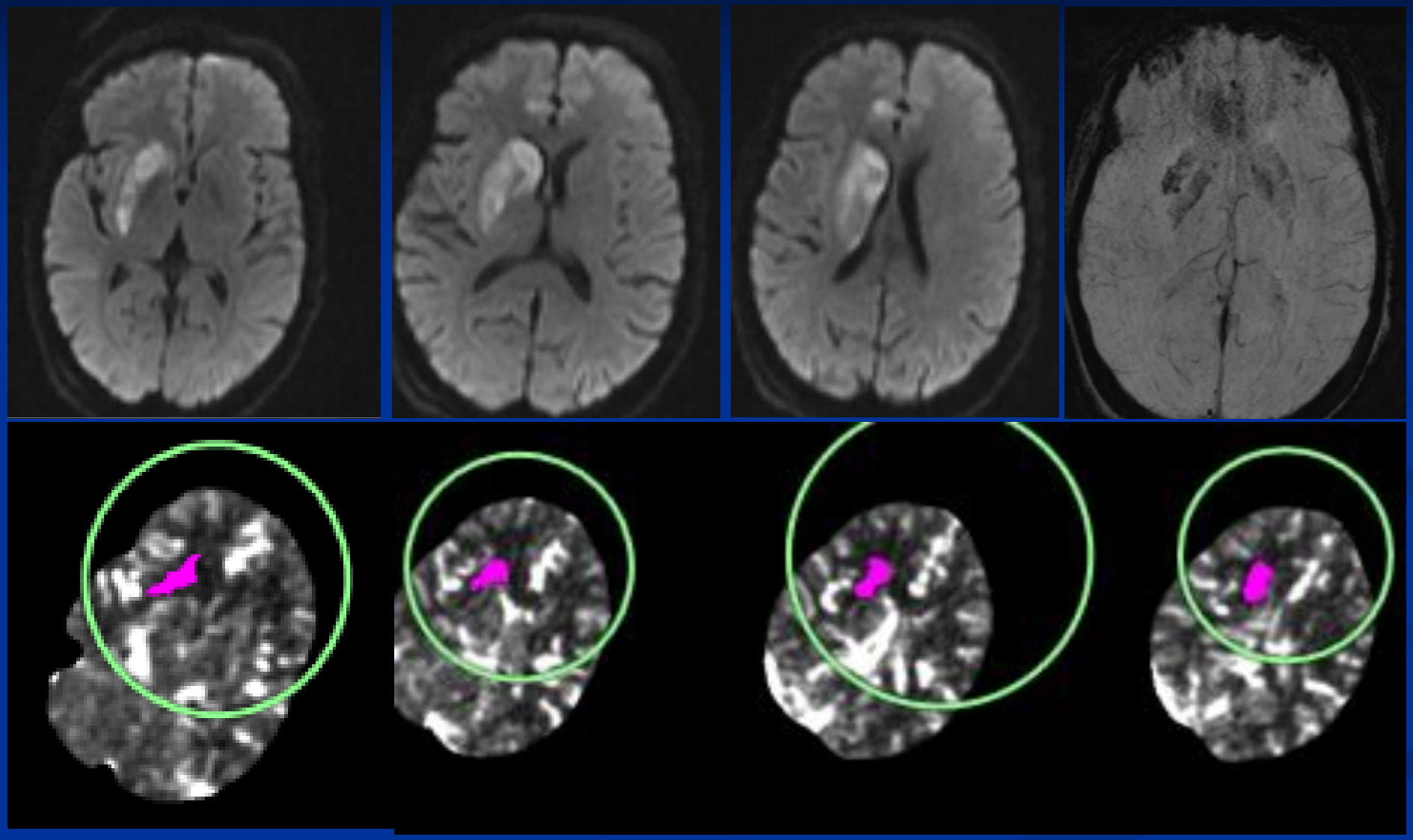
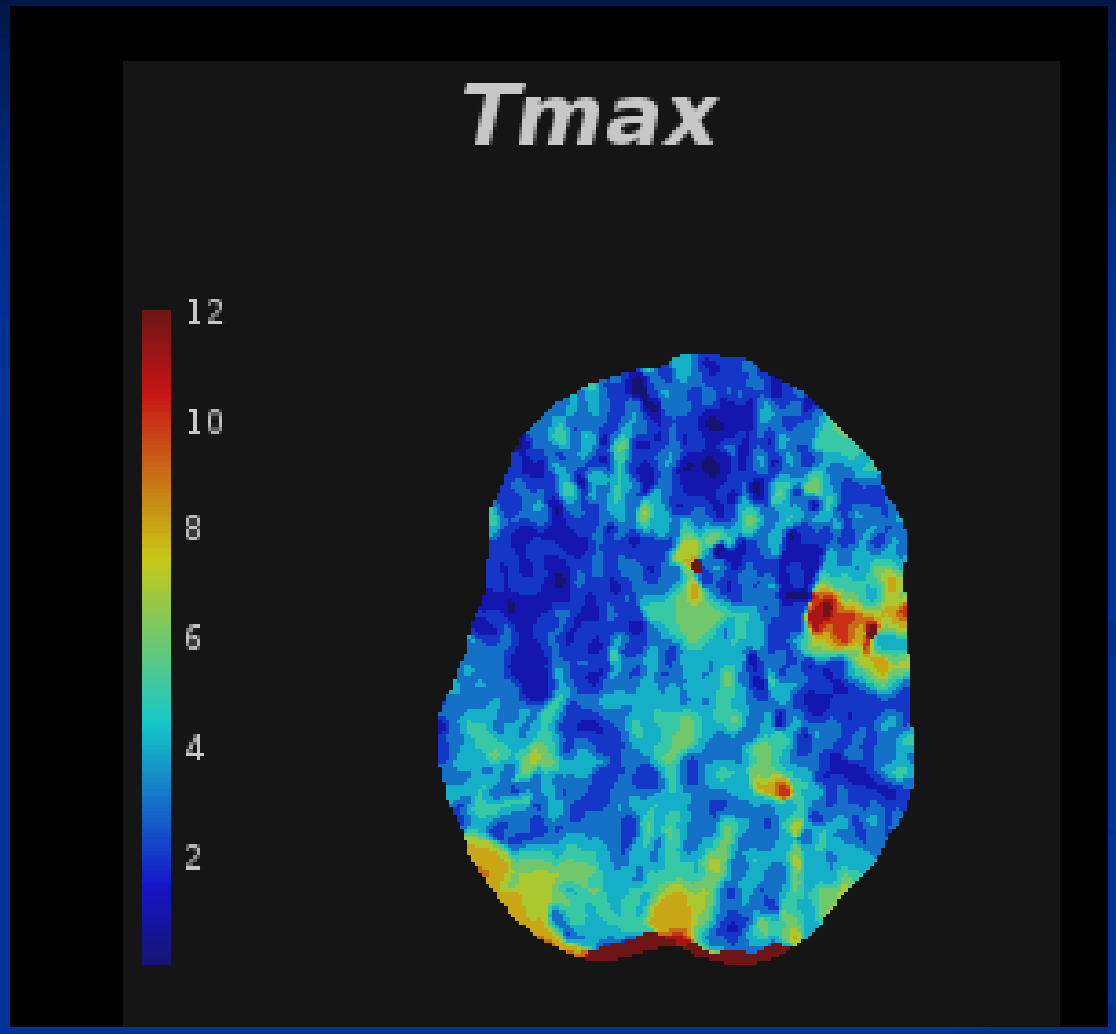
CTA H

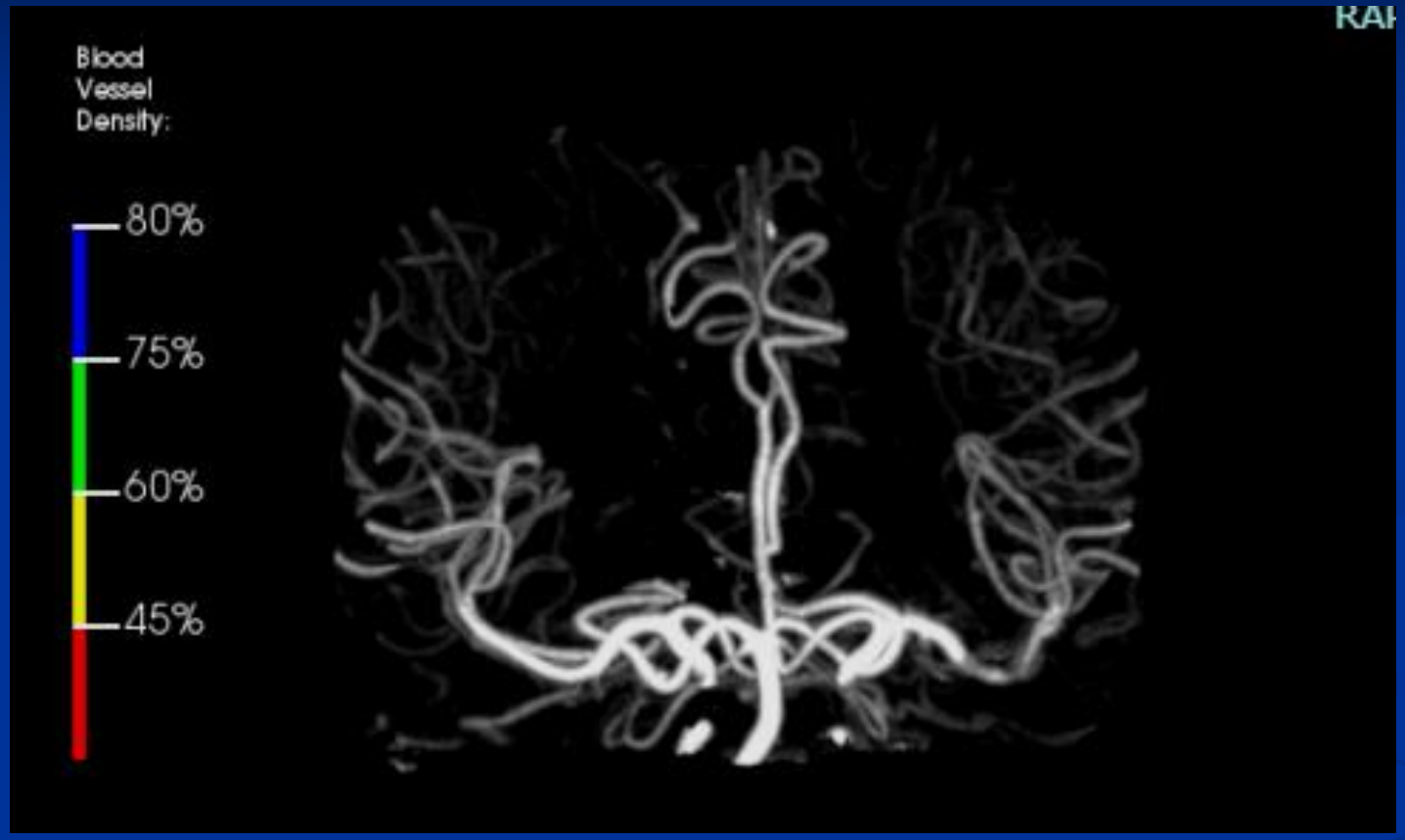

LOC: 0
HFS
CBF<30% volume: 7 ml
Tmax>6.0s volume: 135 ml
Mismatch volume: 128 ml
Mismatch ratio: 19.3
RAPID
Z: 0.38

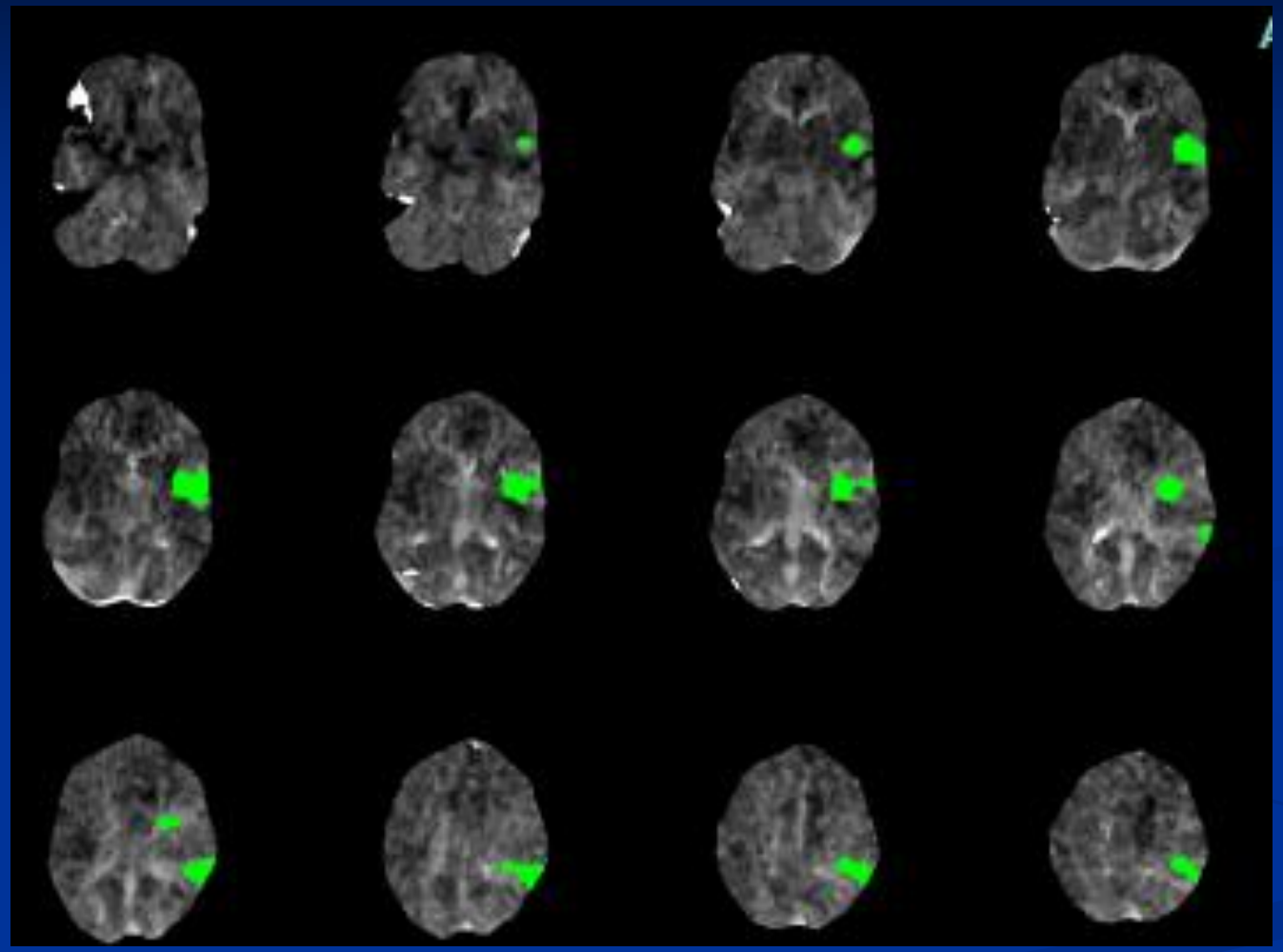

ANGIO
cm

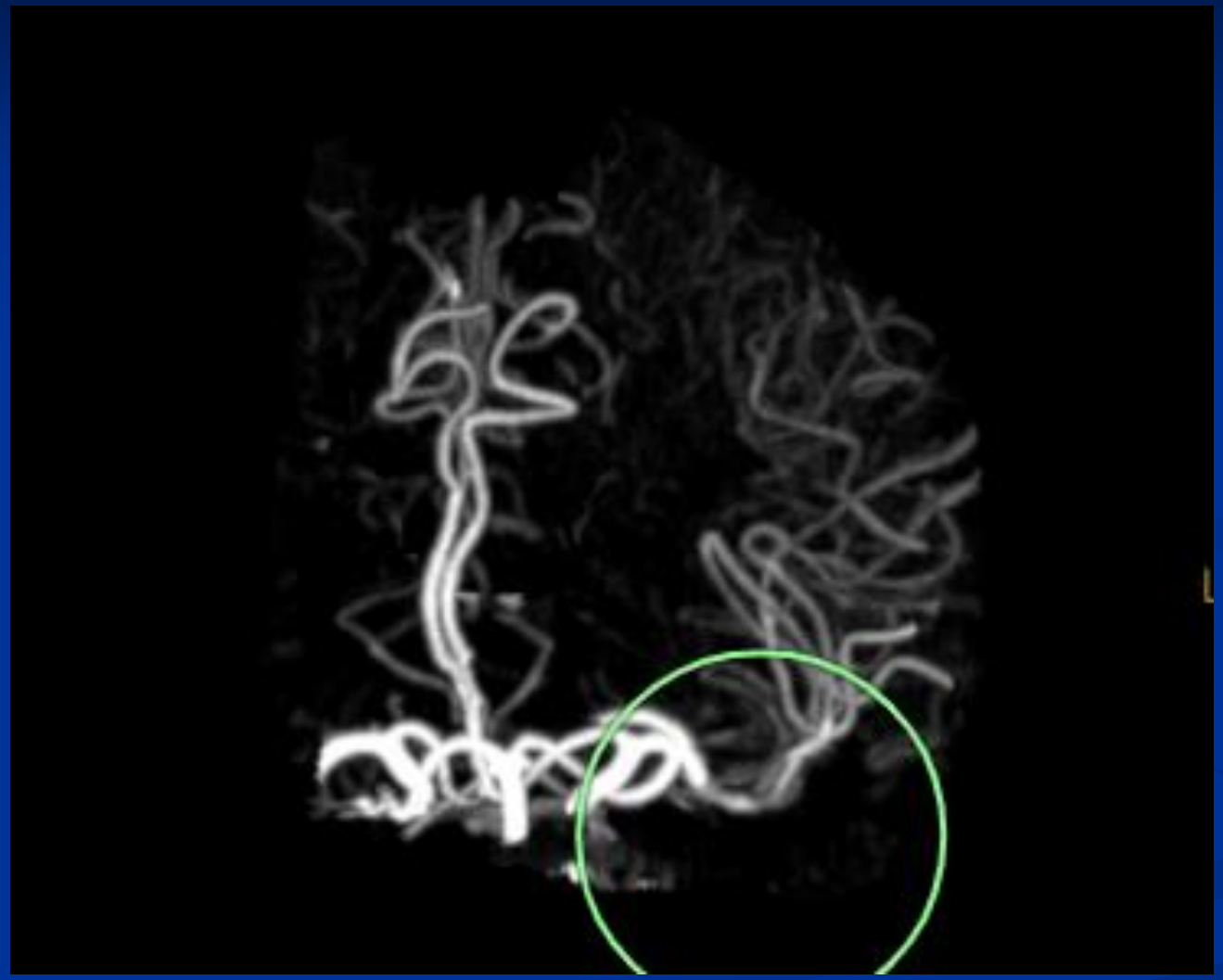

ANGI
* cm

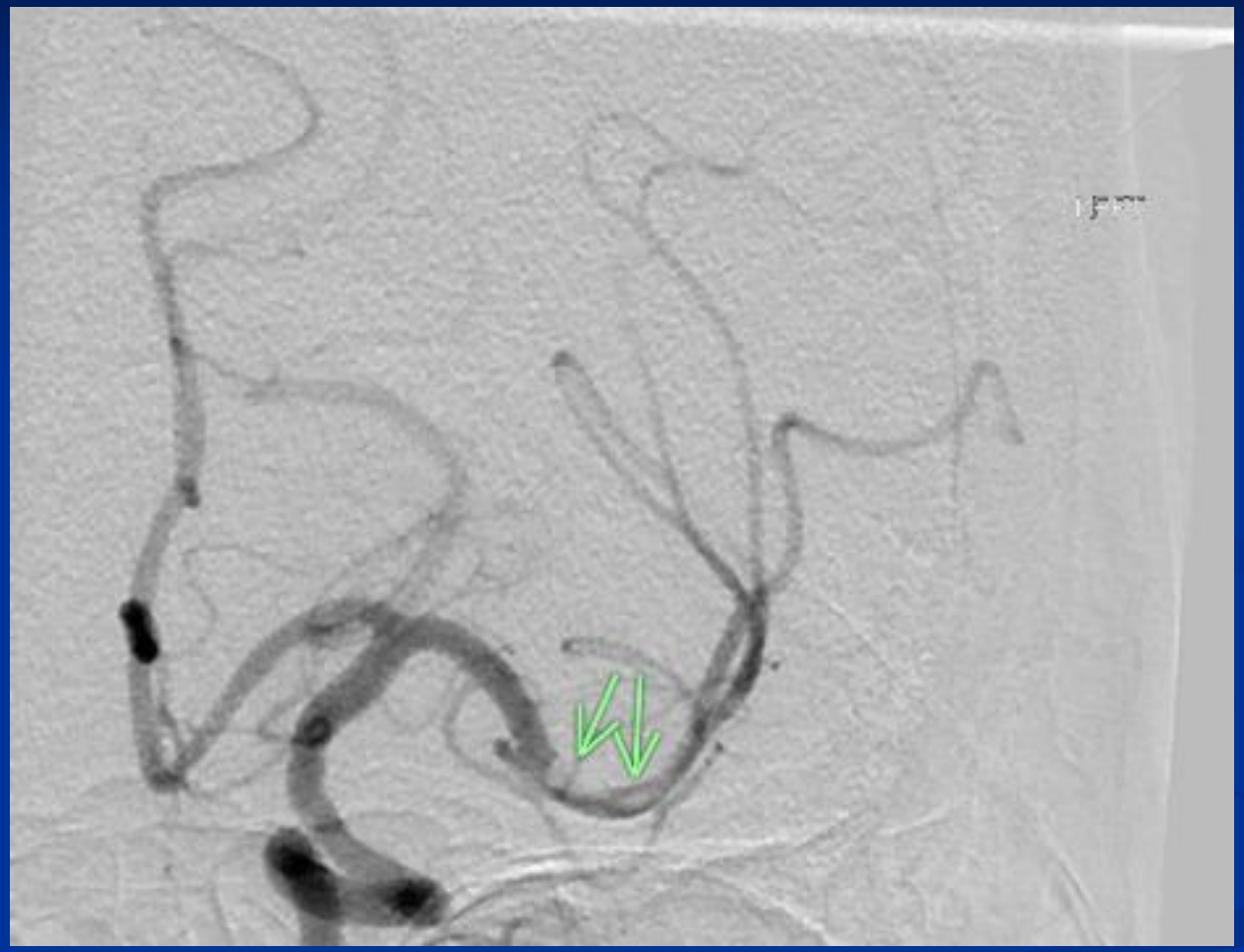


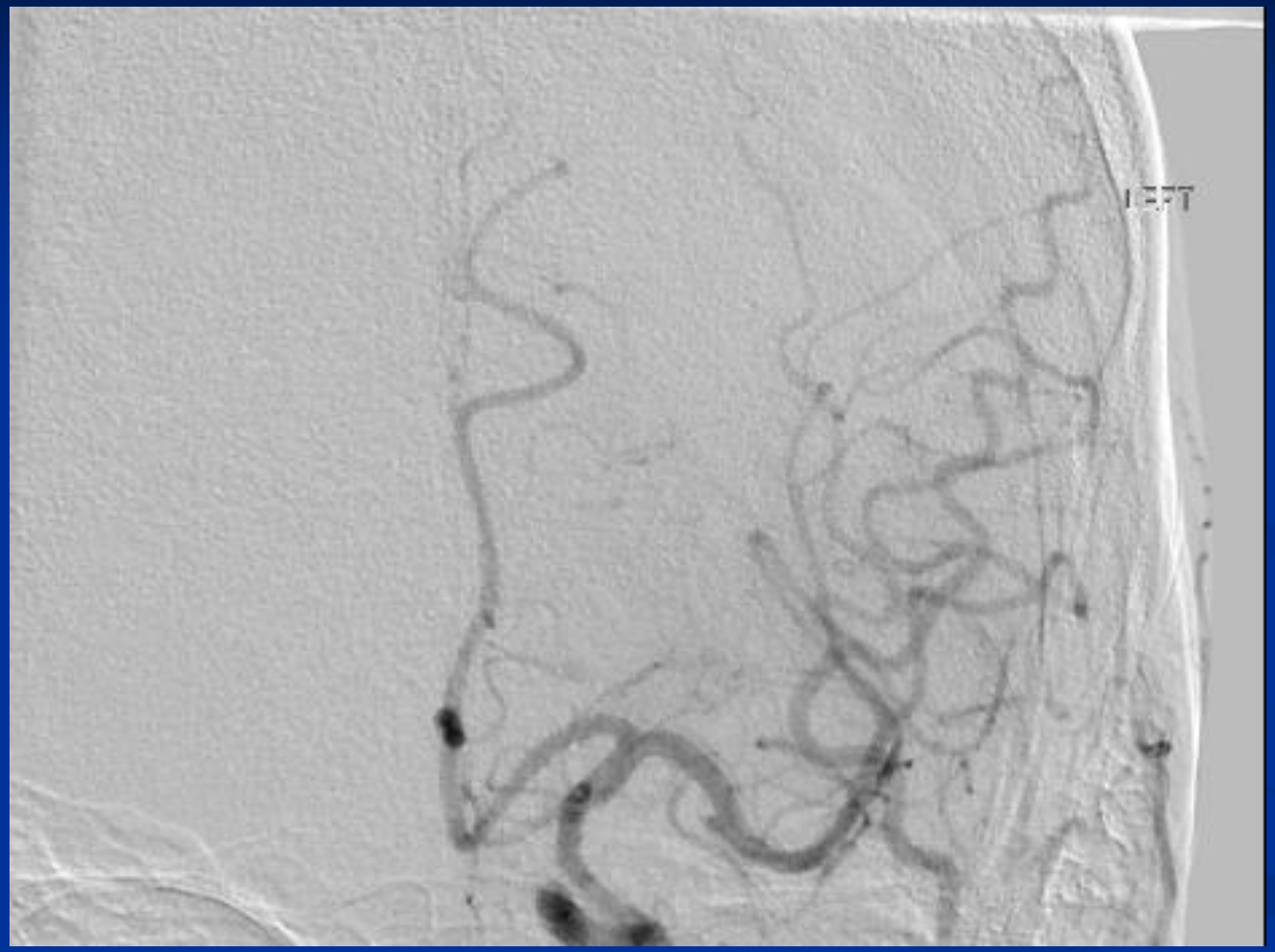

Tmax
12
10
8
6
4
2


Blood
Vessel
Density:
80%
75%
60%
45%



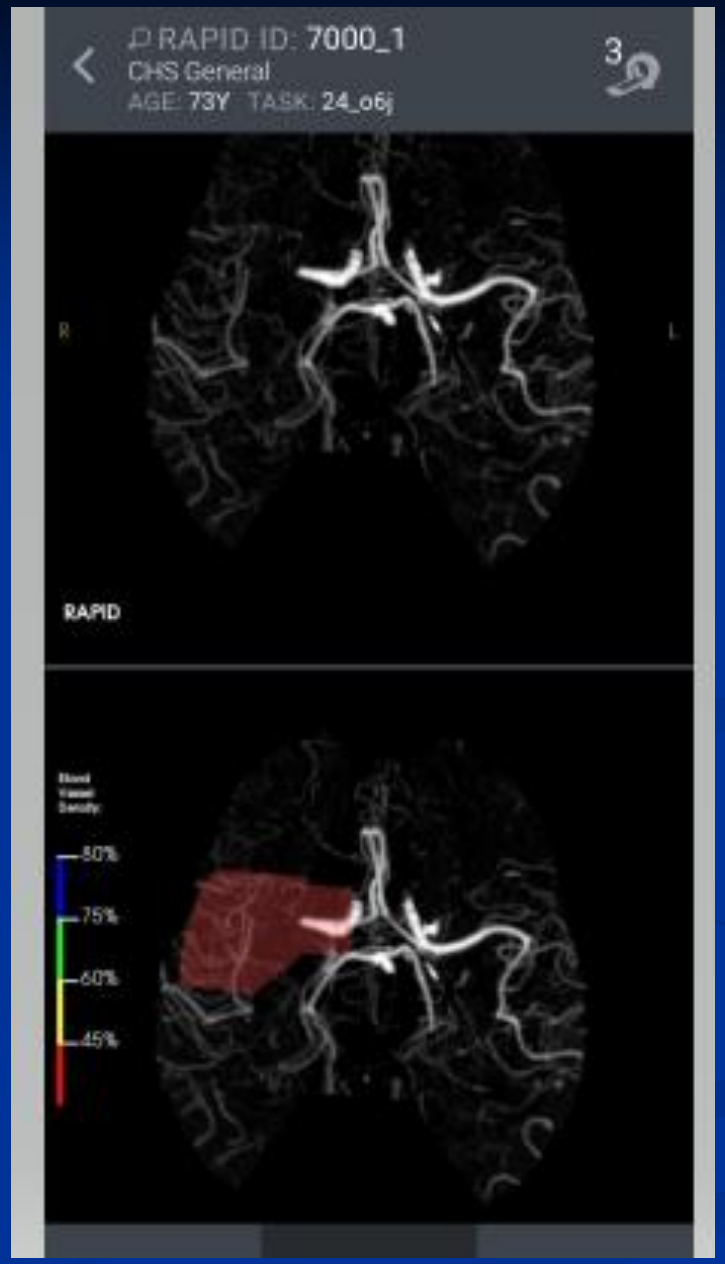





LEFT

IPhone App

- Evaluates
- Notifies Physician
- Notifies Team



AND reimbursement is getting pushed so LOW if you are not in the Imaging Business NOW you cant afford to start

"Reimbursement for MRI studies plummeted more than 54% during the following decade. Similarly, Medicare payment for CT dropped 48% during the 10-year period ending in 2016, from a peak of $705.6 million"

"non-radiologists experienced a massive dip in imaging reimbursement, Kamel et al. reported. Payment for MRI peaked at about $248 million that year, sliding down to about $102 million in 2016, a 59% downturn. Similarly, payment to non-radiologists for CT hit a high-water mark of $284 million in 2006 before plummeting 67%"

"Orthopedic surgeons shared the largest portion of MRI volume among the group, and experienced a 47% decrease in payment from their peak, down to about $49 million in 2016. In CT imaging, cardiologists hold the largest share of reimbursement outside of radiology, experiencing an 82% decline from the peak, down to $10 million in 2016."