BRAIN TUMOUR PERFUSION IMAGING WITH 3T
A CANADIAN PERSPECTIVE

Department of Diagnostic Radiology
Faculty of Heath Sciences

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PRESENTER DISCLOSURE

Faculty: Omar Islam

Relationships with commercial interests: none

Potential for conflict(s) of interest: none

Mitigation of Potential Bias: none

PRESENTATION OBJECTIVES

Review classification and pathophysiology of primary brain tumours

Describe fundamentals of MR Perfusion imaging and protocols at 3T

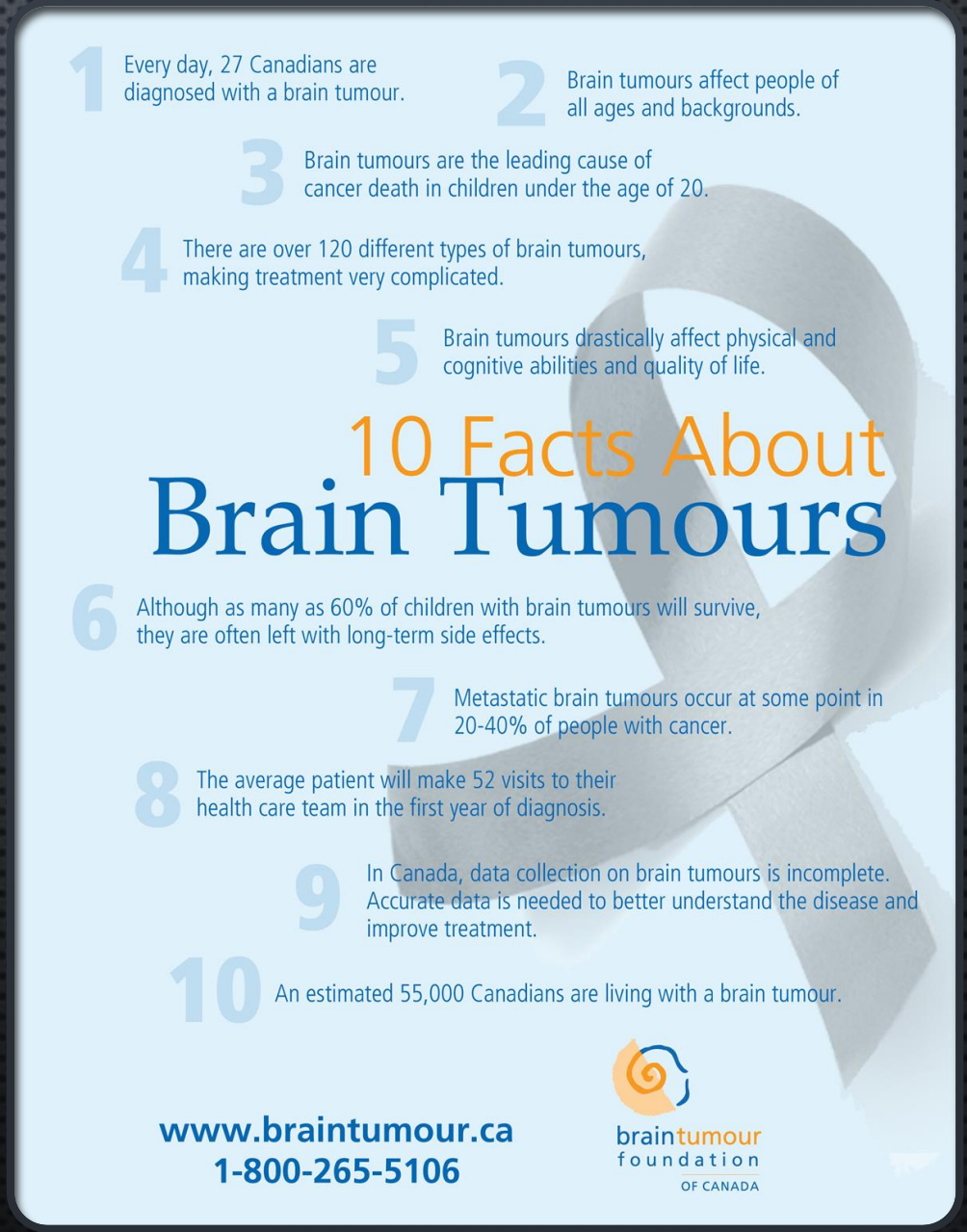
Apply MR perfusion in the assessment of tumour progression versus post-radiation change

PRESENTATION PEARLS

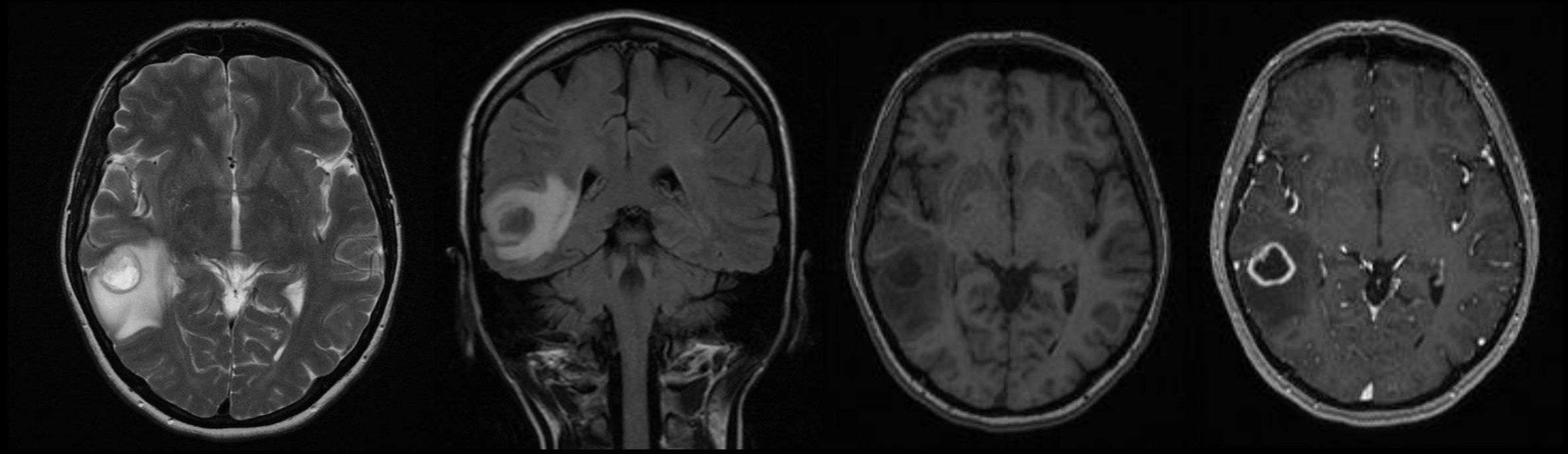
In clinical practice, tumour grading important	*Differentiation of tumour progression vs radiation change paramount*	*In clinical practice*
• *Conventional MRI* • Histopathology	• 3T MRI • *MR Perfusion* • Tumour Genetics	• *Portion of most aggressive tumour (highest grade)* • *Features that suggest de-differentiation* • *Incorporate MR perfusion into routine primary brain tumour protocols*

BRAIN TUMOURS

- EVERY DAY 27 CANADIANS ARE DIAGNOSED WITH A BRAIN TUMOUR
- 8 OUT OF 100,000 PEOPLE
- THE MOST COMMON TYPE OF PRIMARY MALIGNANT BRAIN TUMOUR IS GLIOBLASTOMA (WHO IV). AVERAGE SURVIVAL, EVEN WITH AGGRESSIVE TREATMENT, IS LESS THAN 2 YEARS.
- BRAIN TUMOURS ARE LOCATED AT THE CONTROL CENTRE FOR THOUGHT, EMOTION, AND MOVEMENT, THEY CAN DRAMATICALLY AFFECT AN INDIVIDUAL'S PHYSICAL AND COGNITIVE ABILITIES AND QUALITY OF LIFE.
- THE AVERAGE PATIENT WITH MAKE 52 VISITS TO THEIR HEALTH CARE TEAM IN THE 1ST YEAR OF DIAGNOSIS
- DATA COLLECTION ON BRAIN TUMOURS IS INCOMPLETE. ACCURATE DATA IS NEEDED TO BETTER UNDERSTAND THE DISEASE AND IMPROVE TREATMENT



CONVENTIONAL IMAGING – 1.5/3T



T2 FLAIR T1 T1 POST CONTRAST

Where not otherwise specified, images courtesy of Kingston Health Sciences Centre and Hamilton Health Sciences Centre

CONVENTIONAL IMAGING

Butterfly Glioma

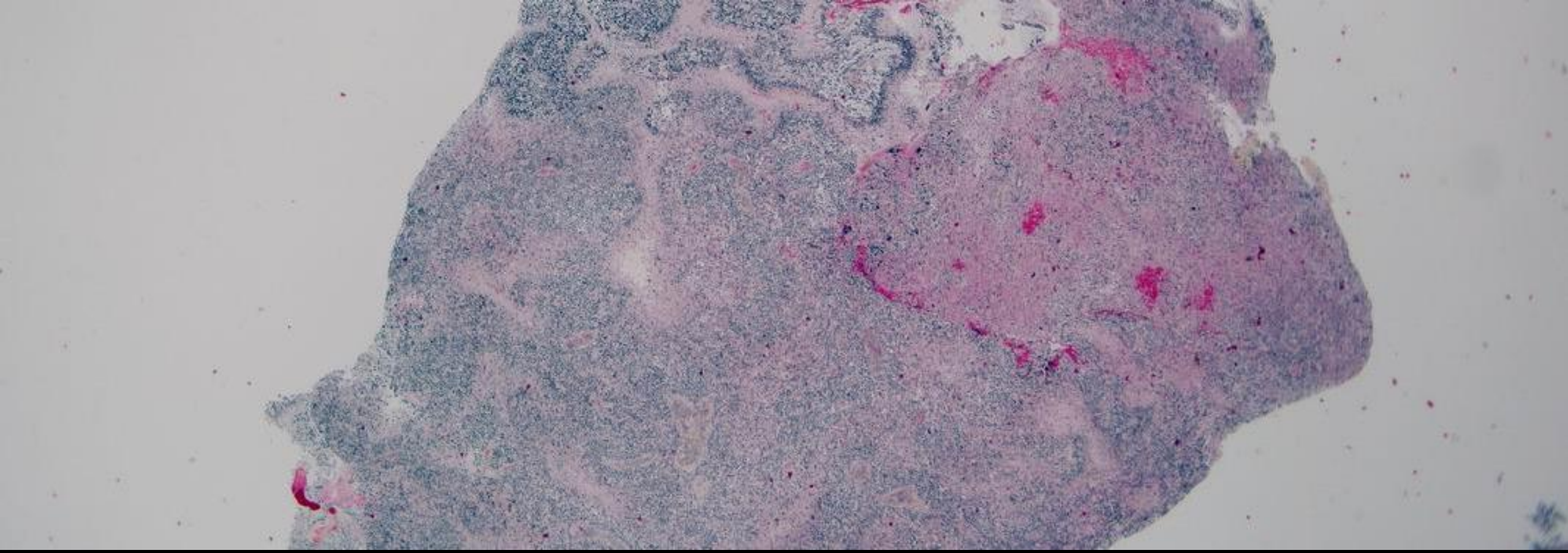
BRAIN TUMOURS

World Health Organization

Physical Appearance

WHO Tumour Grading System

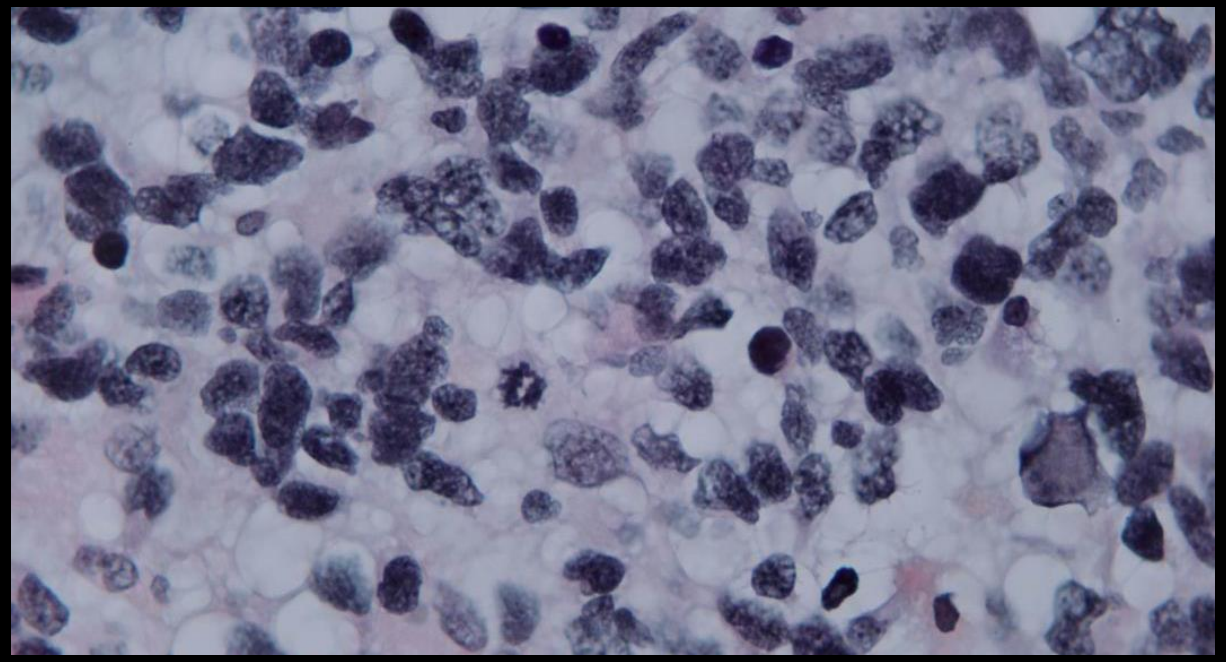
Grade I (Low-grade)	• Slow-growing cells • Cells appear almost normal under microscope • Least malignant / aggressive • Usually associated with long-term survival
Grade II (Low-grade)	• Relatively slow-growing cells • Slightly abnormal cell appearance under microscope • Can invade nearby healthy tissue • Can recur as a higher grade tumour
Grade III (High-grade)	• Actively reproducing abnormal cells • Cells appear abnormally under microscope • Affects nearby healthy tissue • Tumour tends to recur, often becoming a higher grade tumour
Grade IV (High-grade)	• Abnormal cells that reproduce rapidly • Very abnormal cell appearance under microscope • Form new blood vessels to maintain rapid growth • Areas of dead cells in centre (necrosis)

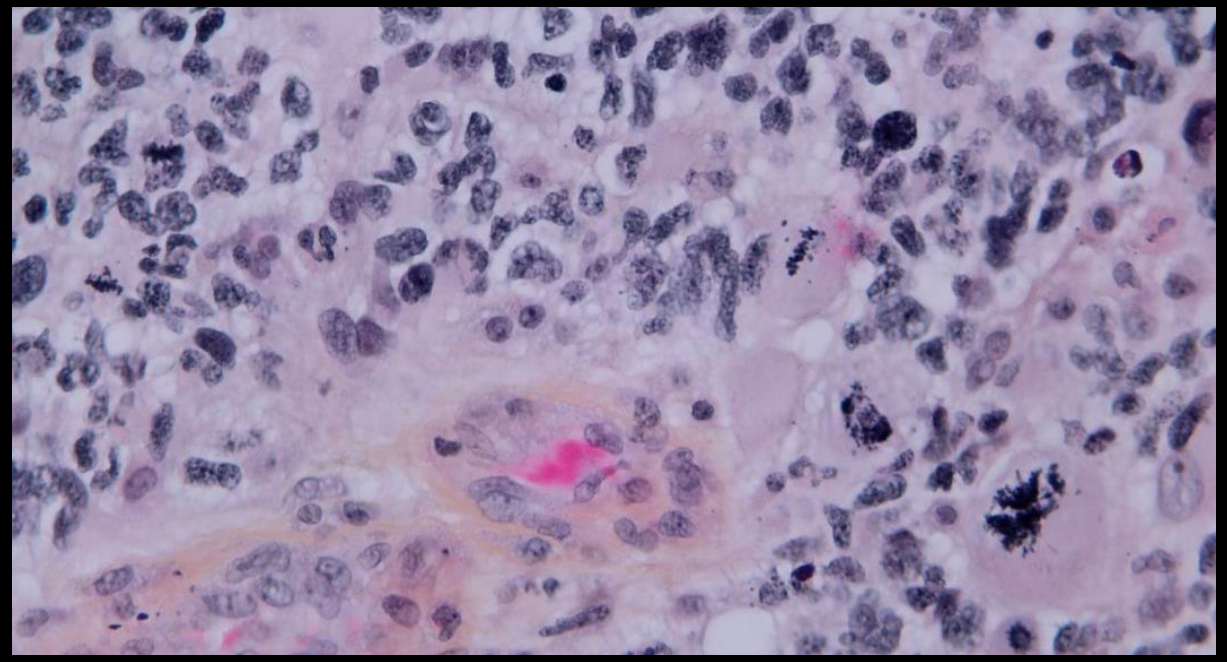


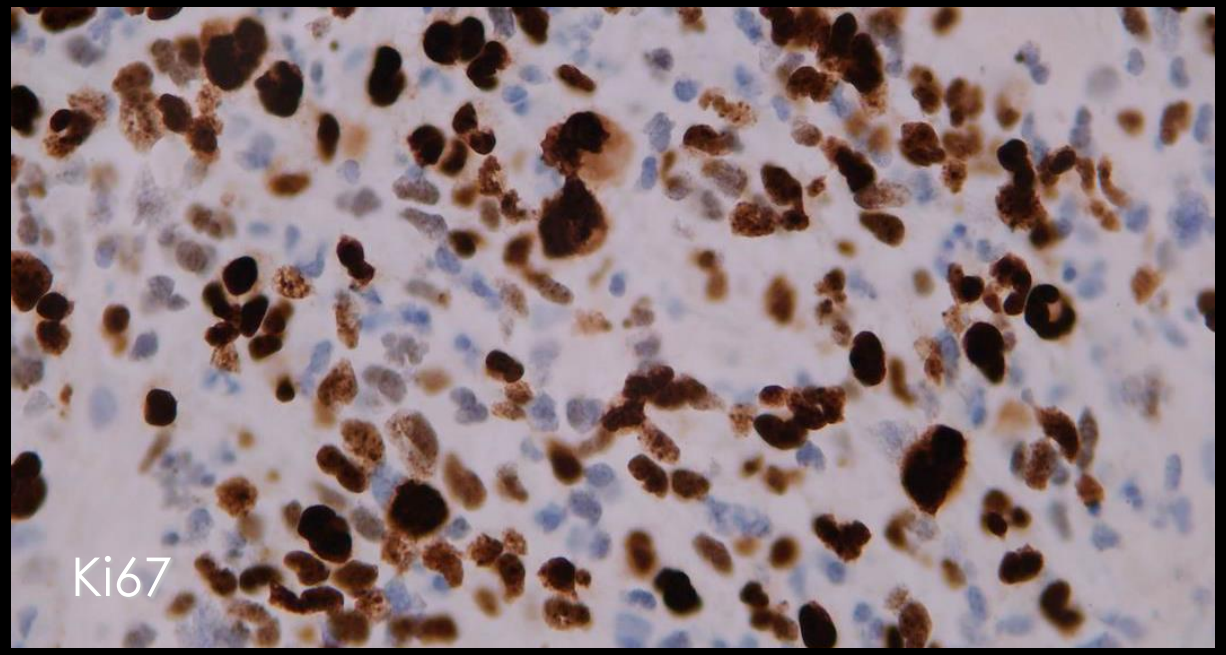
GLIOBLASTOMA – WHO GRADE IV

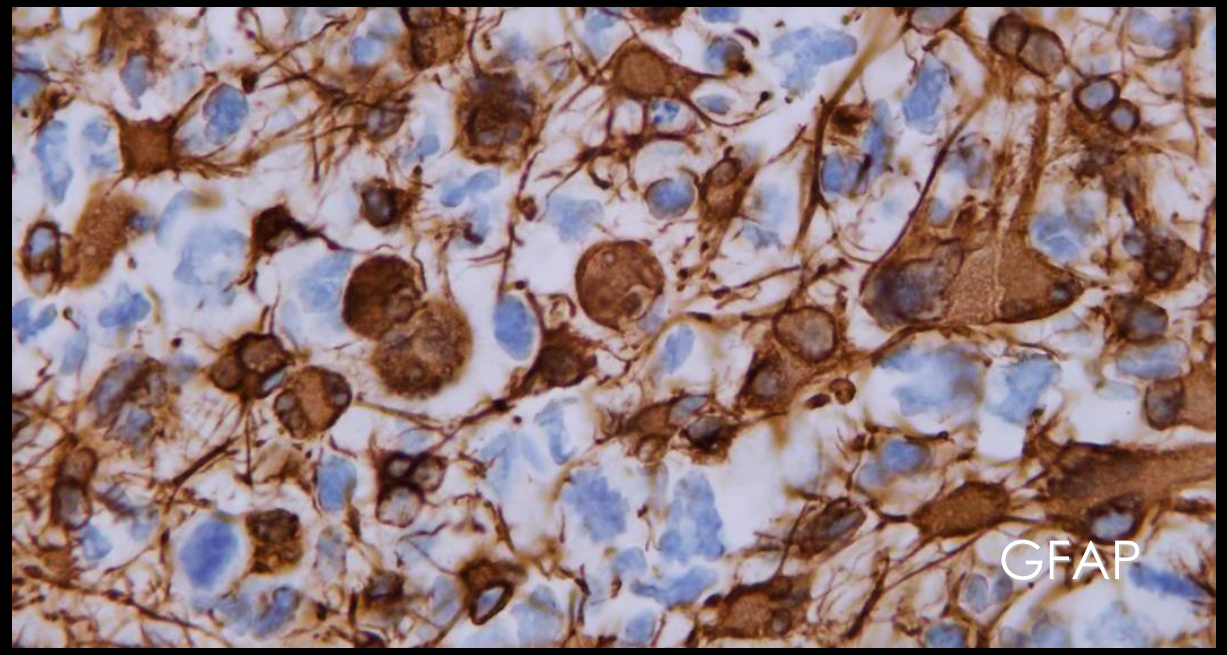
MICROVASCULAR PROLIFERATION WITH ENDOTHELIAL HYPERPLASIA

HIGH PROLIFERATIVE INDEX

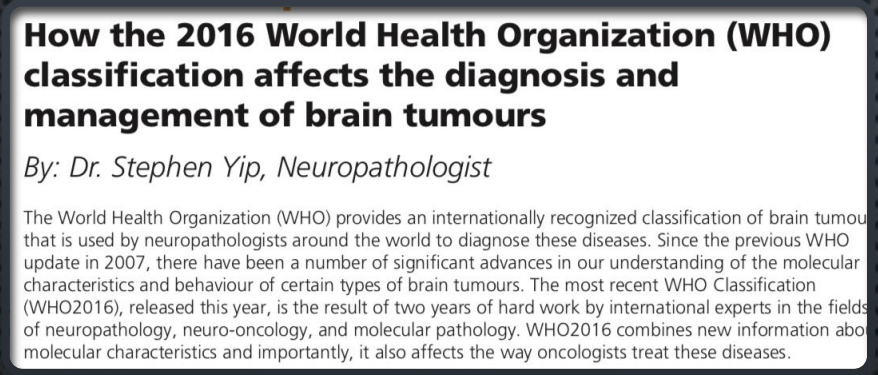





Ki67


GFAP

BRAIN TUMOURS



How the 2016 World Health Organization (WHO) classification affects the diagnosis and management of brain tumours

By: Dr. Stephen Yip, Neuropathologist

The World Health Organization (WHO) provides an internationally recognized classification of brain tumou that is used by neuropathologists around the world to diagnose these diseases. Since the previous WHO update in 2007, there have been a number of significant advances in our understanding of the molecular characteristics and behaviour of certain types of brain tumours. The most recent WHO Classification (WHO2016), released this year, is the result of two years of hard work by international experts in the fields of neuropathology, neuro-oncology, and molecular pathology. WHO2016 combines new information abo molecular characteristics and importantly, it also affects the way oncologists treat these diseases.

- CLASSIFICATION OF GLIOMAS WAS BASED PRIMARILY ON HISTOLOGY AND HOW FAST CELLS GREW AND HOW MUCH TUMOUR CELLS RESEMBLED OR WERE DIFFERENT FROM THE NON-CANCER CELLS OF ORIGIN ("GRADE")
- FOR GLIOMAS, THE MAIN HISTOLOGICAL TYPES HAVE INCLUDED OLIGODENDROGLIOMA AND ASTROCYTOMA. THE GRADE OF THE TUMOUR RANGES FROM THE MOST BENIGN (GRADE I) TO THE MOST MALIGNANT (GRADE IV).
- WHO 2016 COMBINES NEW INFORMATION ABOUT MOLECULAR CHARACTERISTICS AND IMPORTANTLY, IT ALSO AFFECTS THE WAY ONCOLOGISTS TREAT THESE DISEASES
- EXAMPLES:
  - MUTATIONS IN A GENE CALLED ISOCITRATE DEHYDROGENASE (IDH1/2)
  - LOSS OF GENETIC MATERIAL ON CHROMOSOMES 1 AND 19 (1P/19 Q CO-DELETION)

BRAIN TUMOURS

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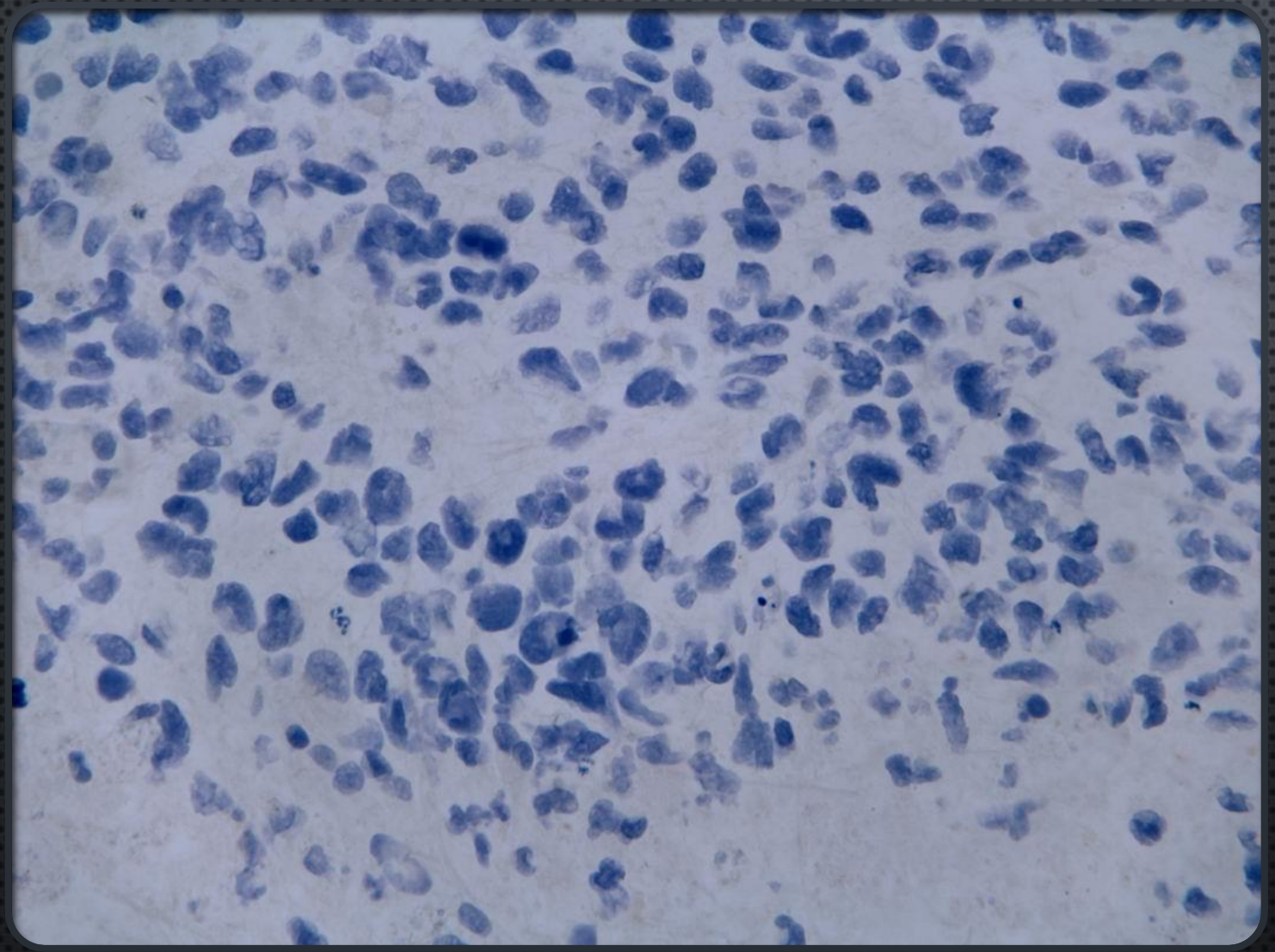
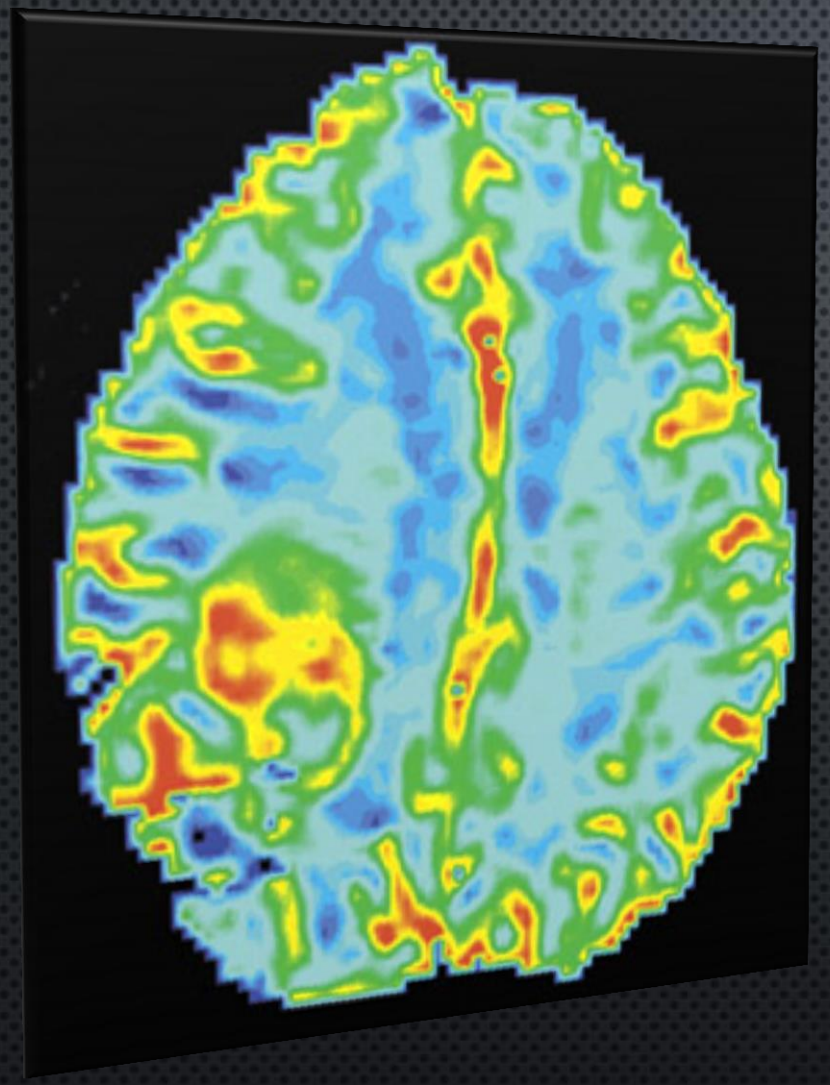
Grade IV (High-grade)	• Abnormal cells that reproduce rapidly • Very abnormal cell appearance under microscope • Form new blood vessels to maintain rapid growth • Areas of dead cells in centre (necrosis)

Biomarkers
IDH1 mutation
1p 19q co-deletion



IDH1^{R132H}

WILD TYPE



3T MR PERFUSION

Where not otherwise specified, images courtesy of Queen's University

PERFUSION IMAGING

Perfusion MRI techniques can be used for quantitative assessment of specific pathophysiologic parameters

→

Perfusion assesses a highly specific indicator of malignancy:

ANGIOGENESIS

ANGIOGENESIS

Tumour hypoxia is one of the initiating events

This leads to secretion of vasoactive substances by the tumour and host immune cells:

VEGF

IL-8, PDGF, EGFR

Induce expression of aquaporins (AQP4), which suppresses the expression of endothelial tight junction proteins, resulting in varying degrees of impairment of the BBB

In GBM, formation of new dense beds of tortuous and abnormal neo-capillaries produces high local tissue blood volume*

* Manoonkitiwongsa PS et al. Contraindications of VEGF-based therapeutic angiogenesis: effects on macrophage density and histology of normal and ischemic brains. *Vascul Pharmacol*. 2006;44(5):316-325).

ANGIOGENESIS

To grow beyond a few mm in size, tumours must develop network of new vascular supply

The new vessels formed are characteristically abnormal by virtue of having increased tortuosity, lack of maturity, and increased permeability due to the presence of large endothelial gaps

This lack of maturity can be exploited by MR perfusion (PWI). The amount of perfusion signal is proportional to the number of vessels (capillaries) in the voxel. Capillary density, in turn, is a reflection of tumour aggressiveness

* Manoonkitiwongsa PS et al. Contraindications of VEGF-based therapeutic angiogenesis: effects on macrophage density and histology of normal and ischemic brains. *Vascul Pharmacol*. 2006;44(5):316-325).

Bottom line:

Perfusion signal is proportional to tumour grade**.

Published April 23, 2015 as 10.3174/ajnr.A4341

WHITE PAPER

ASFNR Recommendations for Clinical Performance of MR Dynamic Susceptibility Contrast Perfusion Imaging of the Brain

K. Welker, J. Boxerman, A. Kalnin, T. Kaufmann, M. Shiroishi, and M. Wintermark; for the American Society of Functional Neuroradiolgy MR Perfusion Standards and Practice Subcommittee of the ASFNR Clinical Practice Committee

HOW TO PERFORM MR PERFUSION

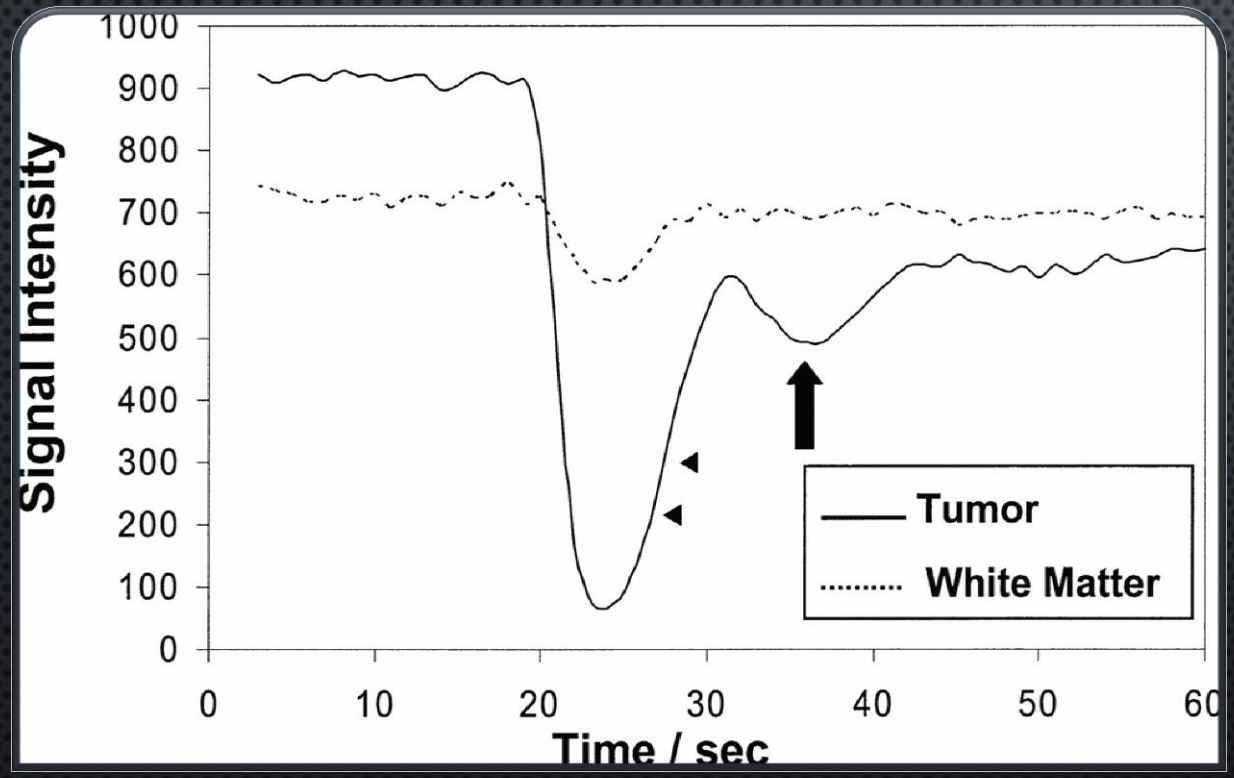
3T MRI PERFUSION PROTOCOL – QUEEN'S

- Sequence name - ep2d_fid
- Sequence type - Single Shot FID EPI, T2* weighted
- Parameters:
  - 2D acquisition in Axial plane
  - TR = 1860
  - TE = 30
  - Slice thickness = 4.5
    Resolution = 128
  - Matrix = 1.8 x1.8 x4.5
  - Acceleration Factor = Grappa 2
  - Bandwidth = 1446
- Number of slices = 26 (whole head coverage)
- Number of measurements = 50
- Scan Time = 1:39
- Auto generates maps - GBP, PBP, TTP, relCBV, relCBF, relMTT
- Injection setup:
  - Double Gado dose (0.1ml/Kg x 2)
  - 4ml/sec bolus followed by 20ml of saline at the same speed.
  - Good IV access with 22Gauge cannula if possible in antecubital region.
- Running the Sequence instructions:
  - Trigger the injection, wait 10 seconds then start the scan (to ensure an accurate baseline before Gado arrives).

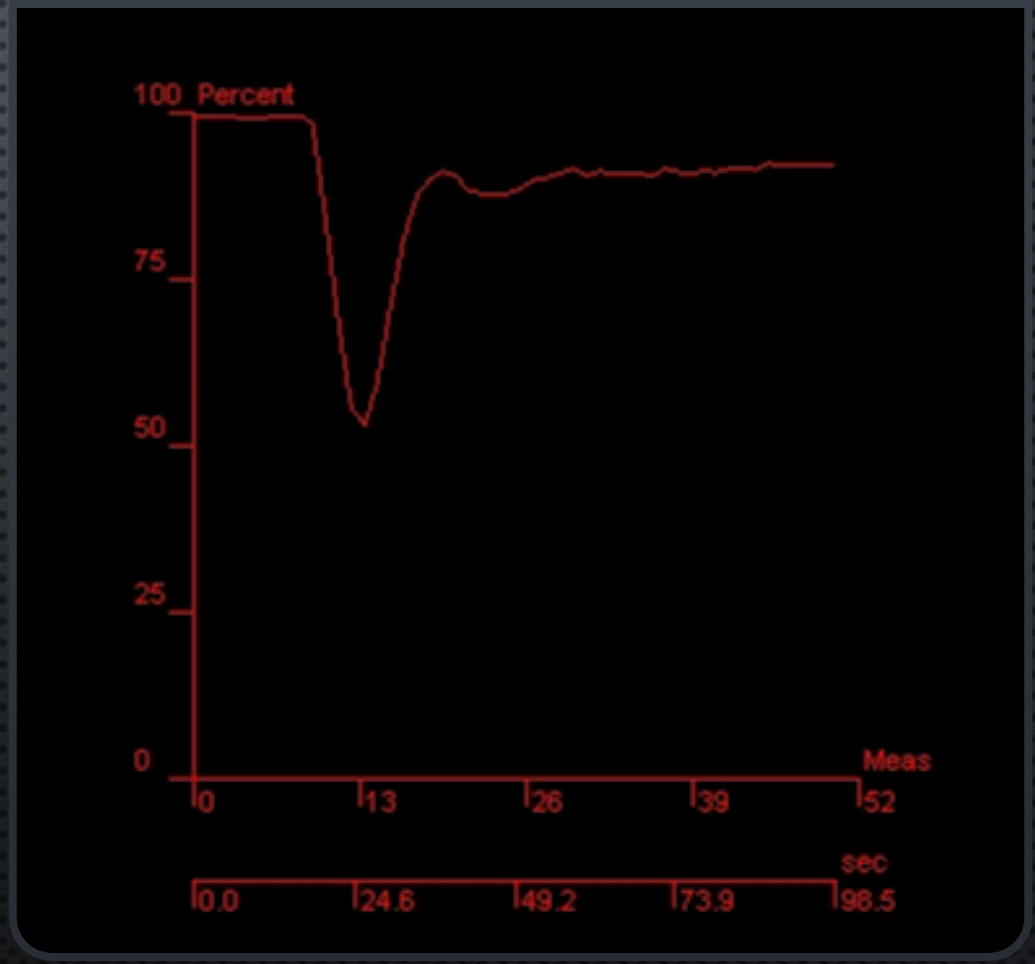
3T MR PERFUSION – RAW DATA IMAGES

- Dynamic IV injection
  - ASL
- ~ 650-700 images
- Temporally and anatomically spaced

3T MR PERFUSION - KINETICS

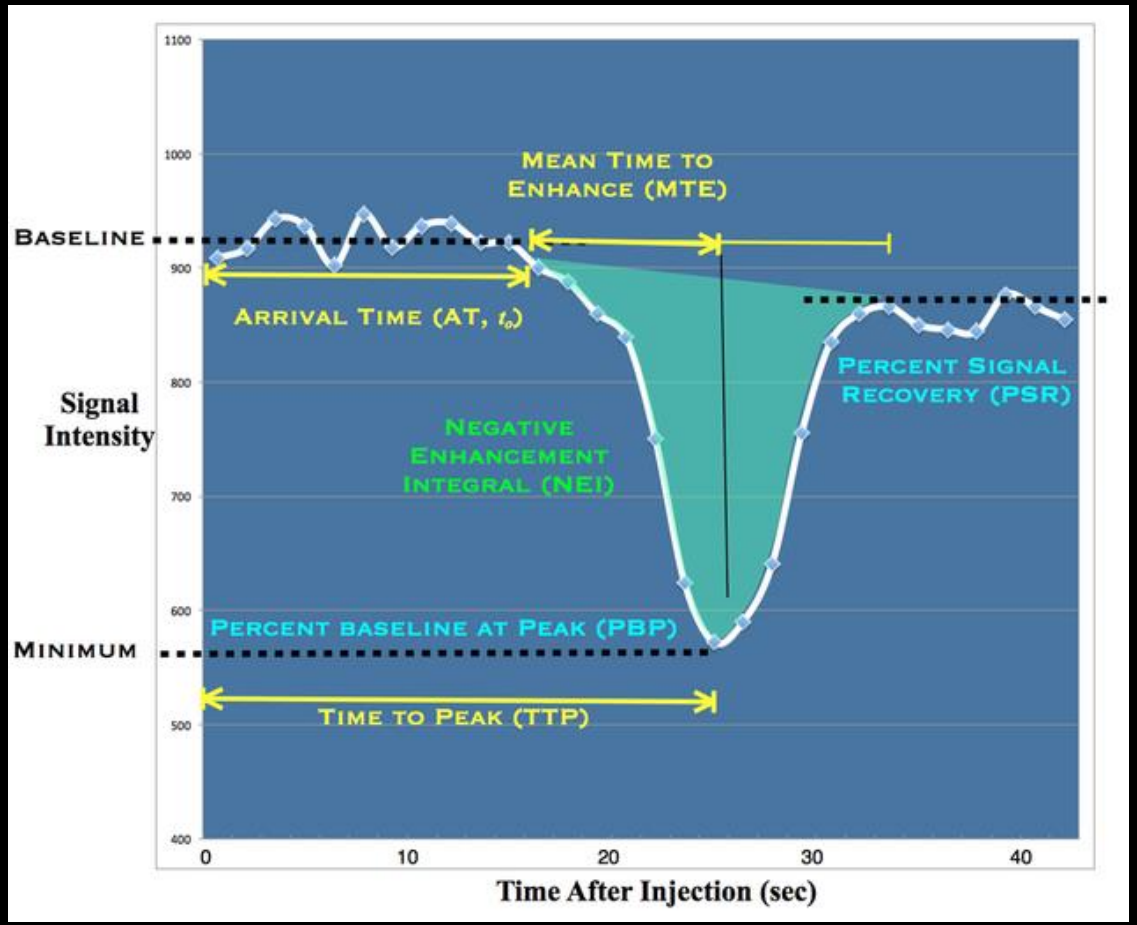


Cha S et al. Radiology 2002;223:11-29



MR PERFUSION KINETICS

- NEGATIVE ENHANCEMENT INTEGRAL
  - TOTAL AREA ("INTEGRAL") UNDER THE SIGNAL INTENSITY CURVE DURING FIRST PASS OF GD
  - TOTAL AMOUNT OF CONTRAST TRANSITING THROUGH THE REGIONAL VASCULAR SYSTEM AND IS ROUGHLY PROPORTIONAL TO BLOOD VOLUME
  - BASELINE DOES NOT RETURN TO NORMAL AT THE END OF THE FIRST PASS. AN ARBITRARY DECISION MUST THEN BE TO MADE AS TO DEFINE THE RIGHT HAND LIMIT OF INTEGRATION



Welker K, Boxerman J, Kalnin A, et al. ASFNR recommendations for clinical performance of MR dynamic susceptibility contrast perfusion imaging of the brain. AJNR Am J Neuroradiol 2015; 36: E41-E51.

MR PERFUSION APPLICATIONS

MR PERFUSION APPLICATIONS

Grading

GLIOMA GRADING

Strong correlation between rCBV from perfusion MRI and glioma grade*

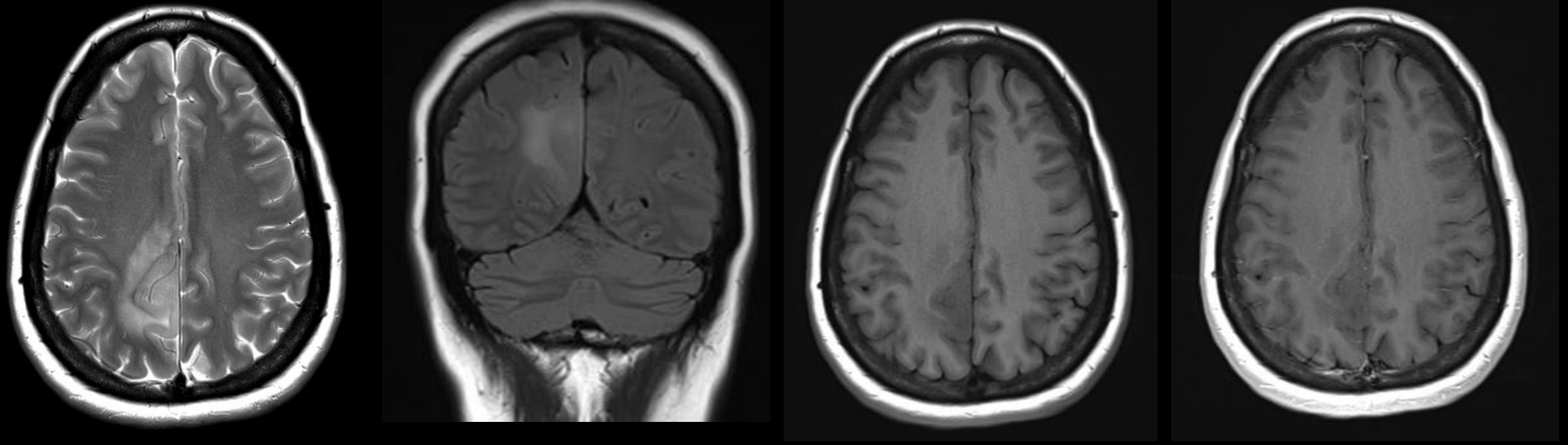
Bisdas et al. found that $rCBV_{max}$ greater than 4.2 was predictive of recurrence and that $rCBV_{max}$ of 3.8 or less was predictive of 1-year survival of astrocytoma**

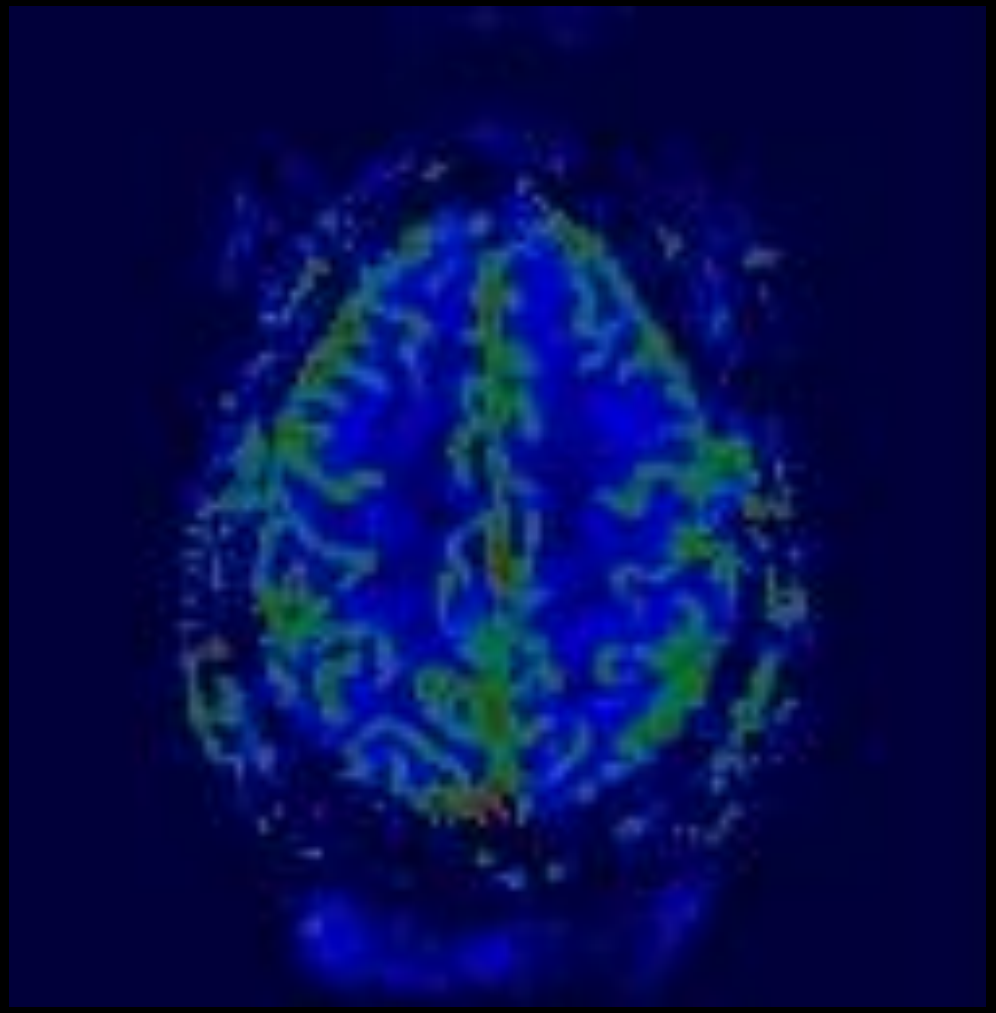
- * Shin JH, Lee HK, Kwun BD, et al. Using relative cerebral blood flow and volume to evaluate the histopathologic grade of cerebral gliomas: preliminary results. *AJR* 2002; 179:783–789
- **Bisdas S, Kirkpatrick M, Giglio P, Welsh C, Spampinato MV, Rumboldt Z. Cerebral blood volume measurements by perfusion-weighted MR imaging in gliomas: ready for prime time in predicting short-term outcome and recurrent disease? *AJNR* 2009; 30:681–688

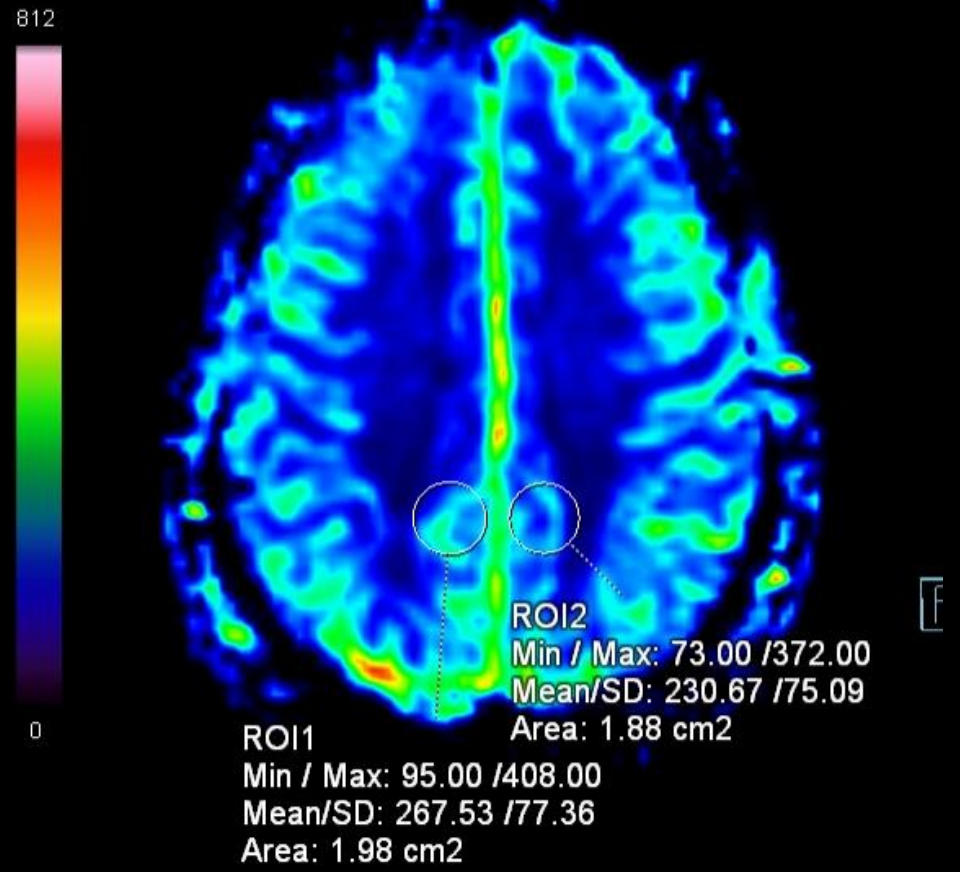
CASE 1

ASYMMETRIC SNHL!

ACOUSTIC SCAN NEGATIVE, BUT …






812
0
ROI2
Min / Max: 73.00 /372.00
Mean/SD: 230.67 /75.09
Area: 1.88 cm2
ROI1
Min / Max: 95.00 /408.00
Mean/SD: 267.53 /77.36
Area: 1.98 cm2

rCBV 1.16:1

LOW VS HIGH GRADE - CBV

High-grade and low-grade gliomas: differentiation by using perfusion MR imaging. Hakyemez B et al. Clin Radiol. 2005 Apr;60(4):493-502

Study involved 33 patients (22 high-grade and 11 low-grade glioma cases)

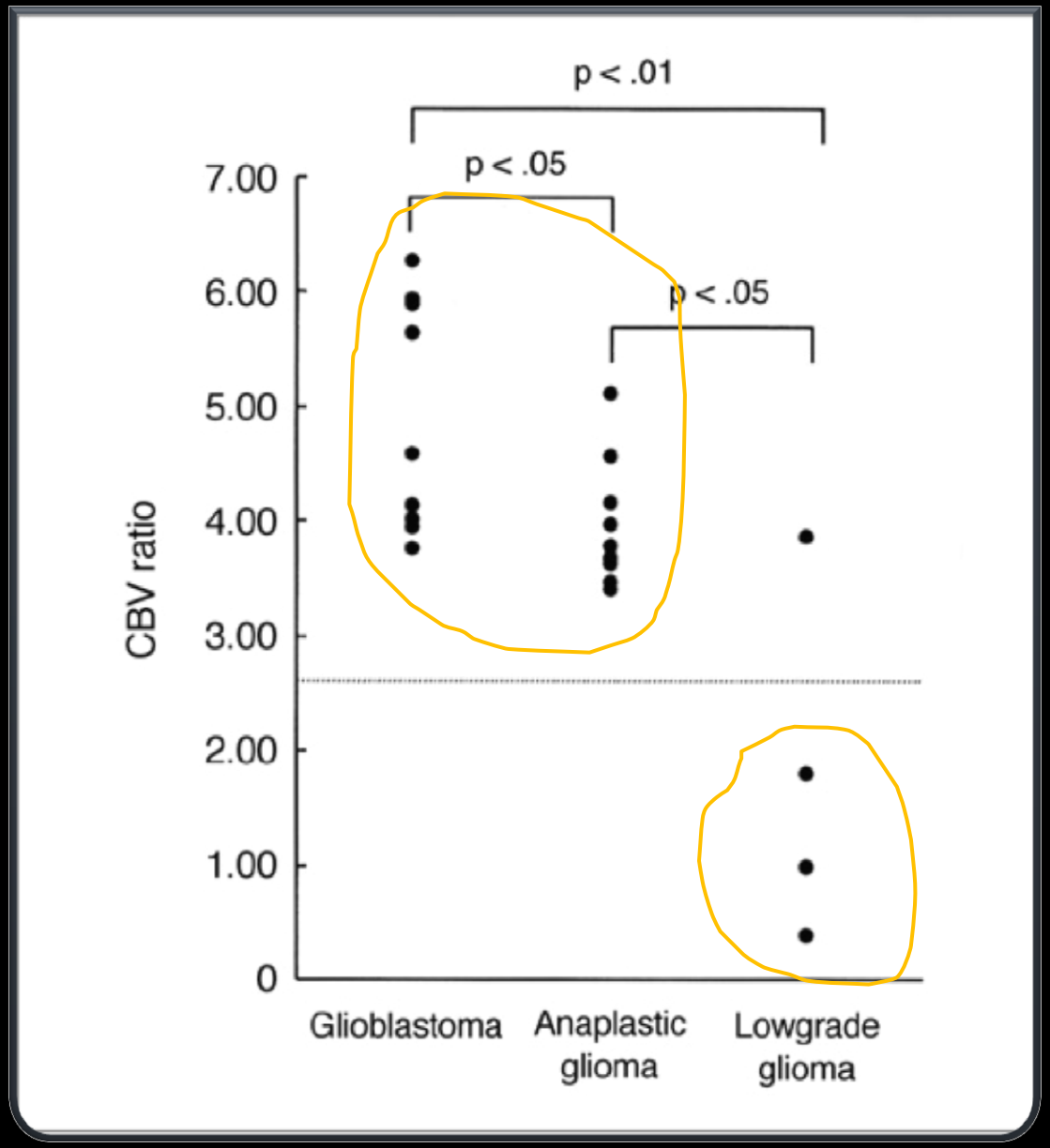
The rCBV ratios of the lesions were obtained by dividing the values obtained from the normal white matter of the contralateral hemisphere

In high-grade gliomas, rCBV ratio was 6.50+/-4.29

In low-grade gliomas, rCBV ratio was 1.69+/-0.51

Perfusion MRI is useful in the preoperative assessment of the histopathological grade of gliomas

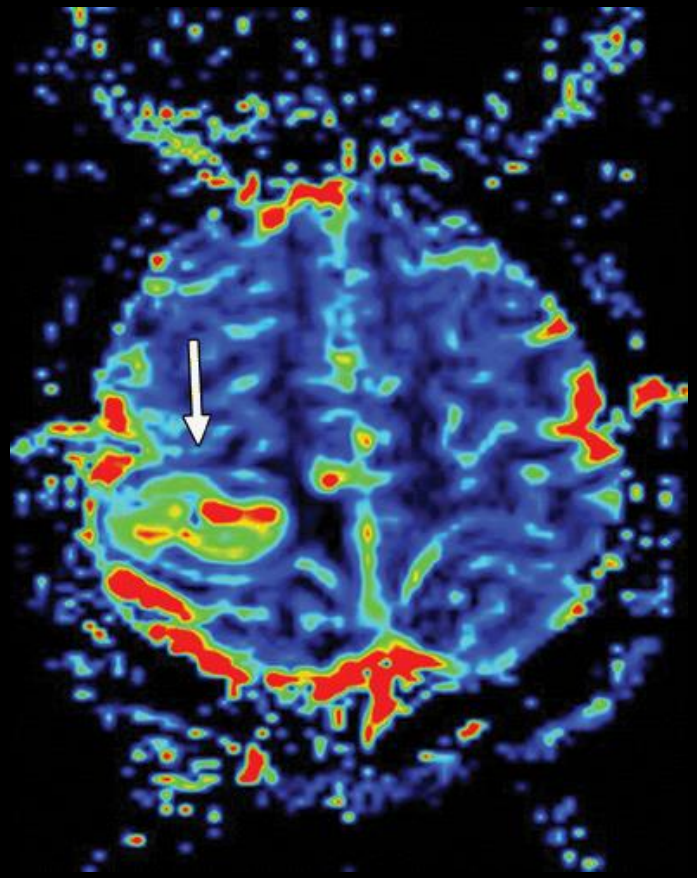
Clin Radiol. 2005 Apr;60(4):493-502

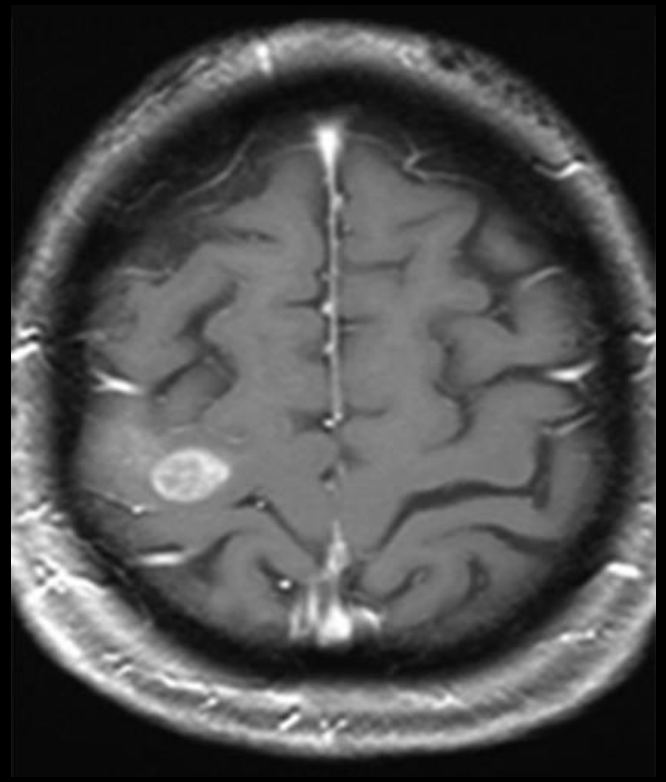


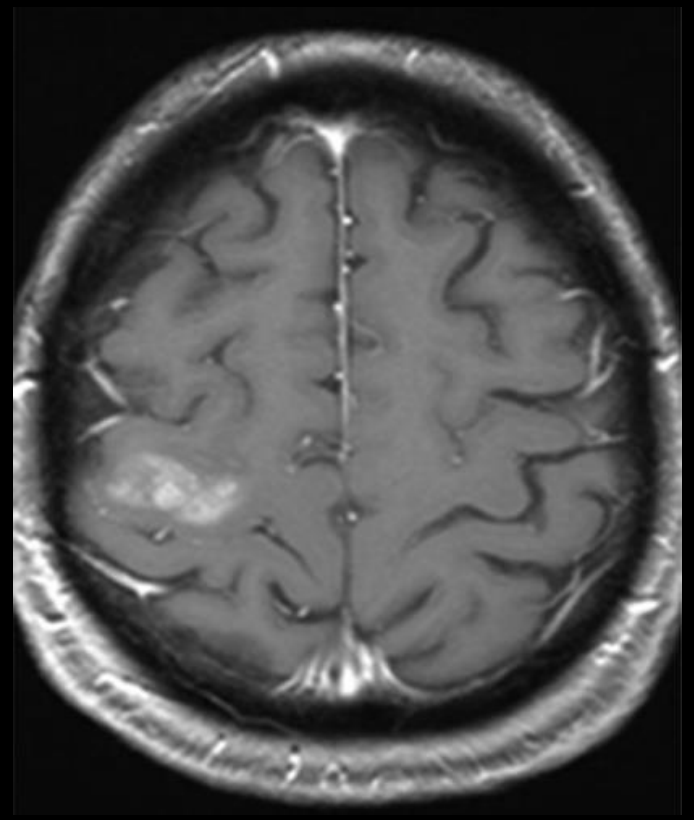
MR PERFUSION - TUMOUR GRADE

- KOREAN J RADIOL. 2001 JAN-MAR;2(1):1-7.

CASE 2







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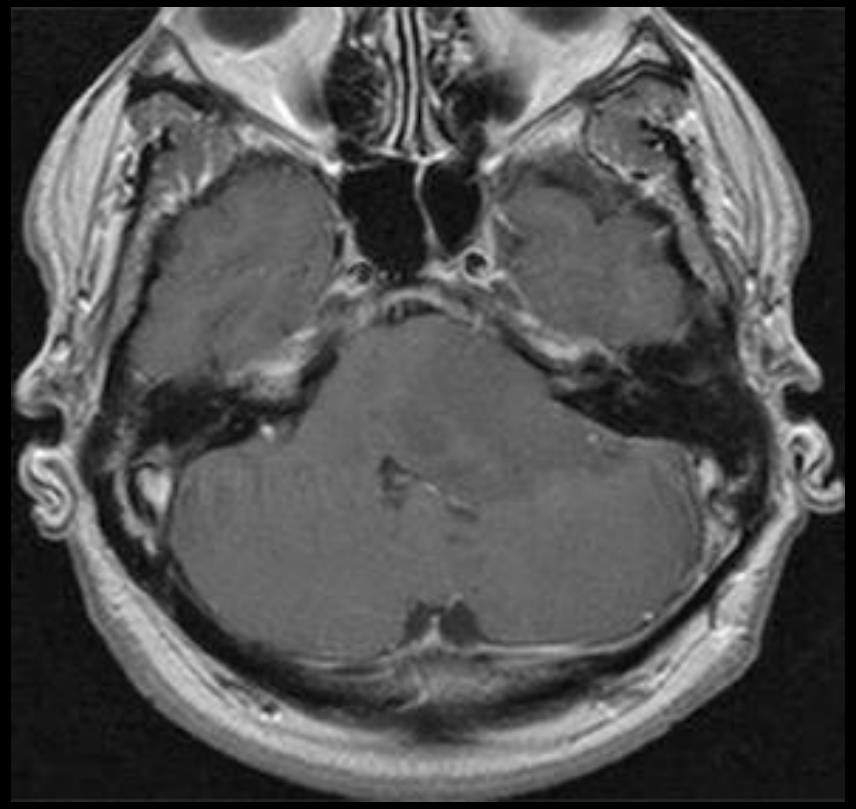
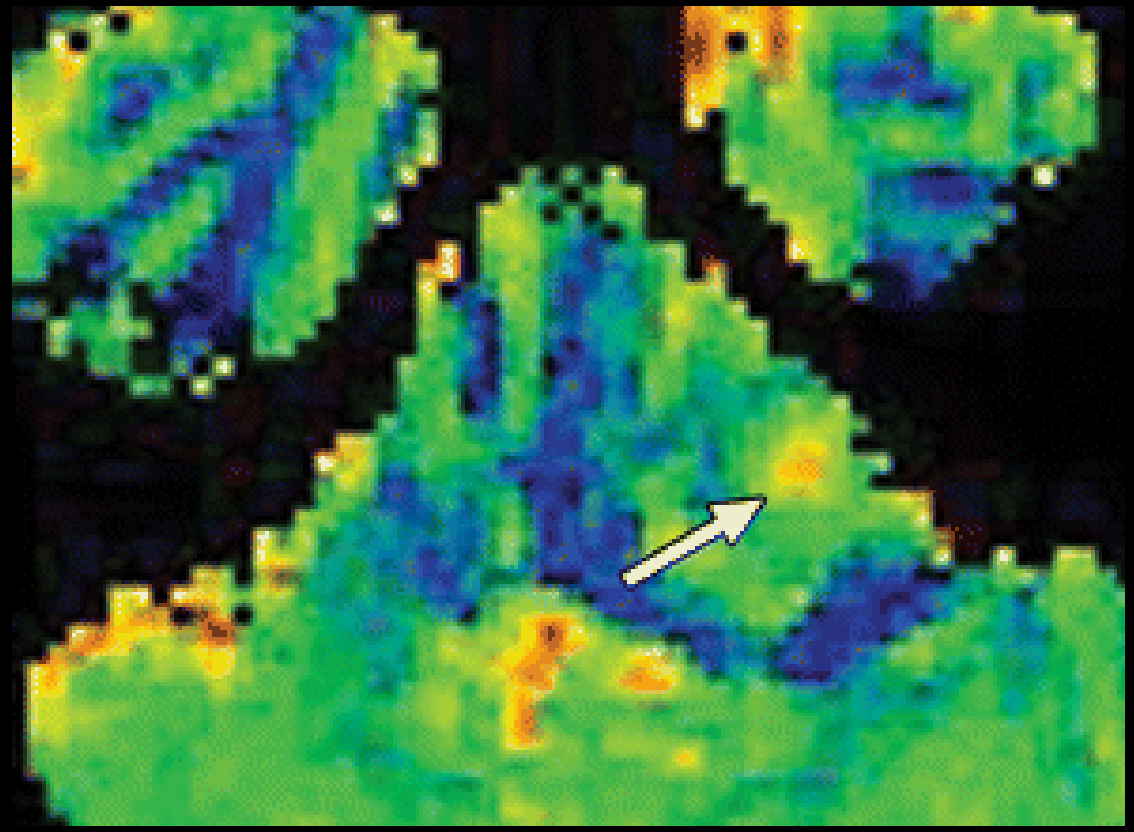


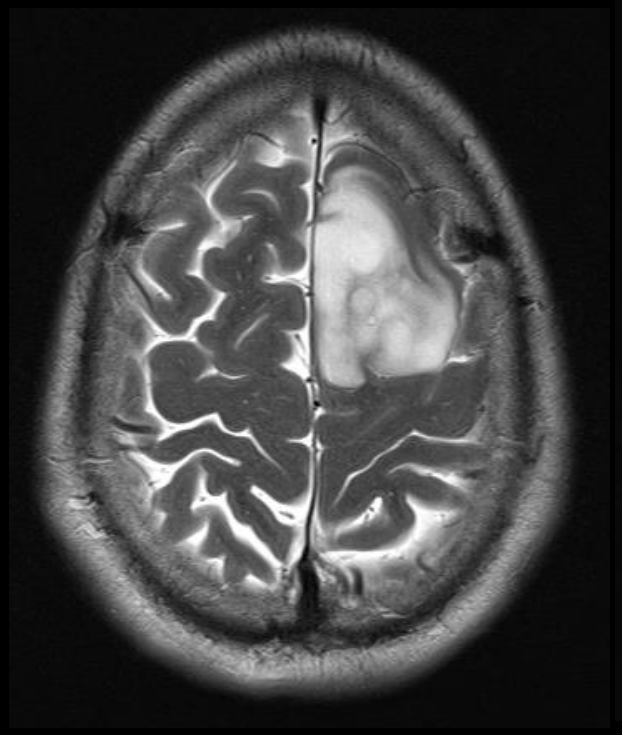


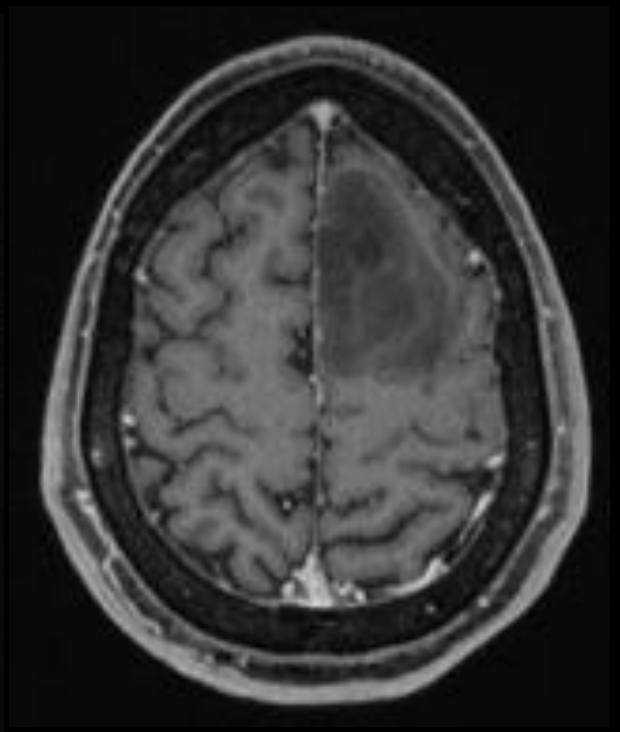
rCBV > 3.5

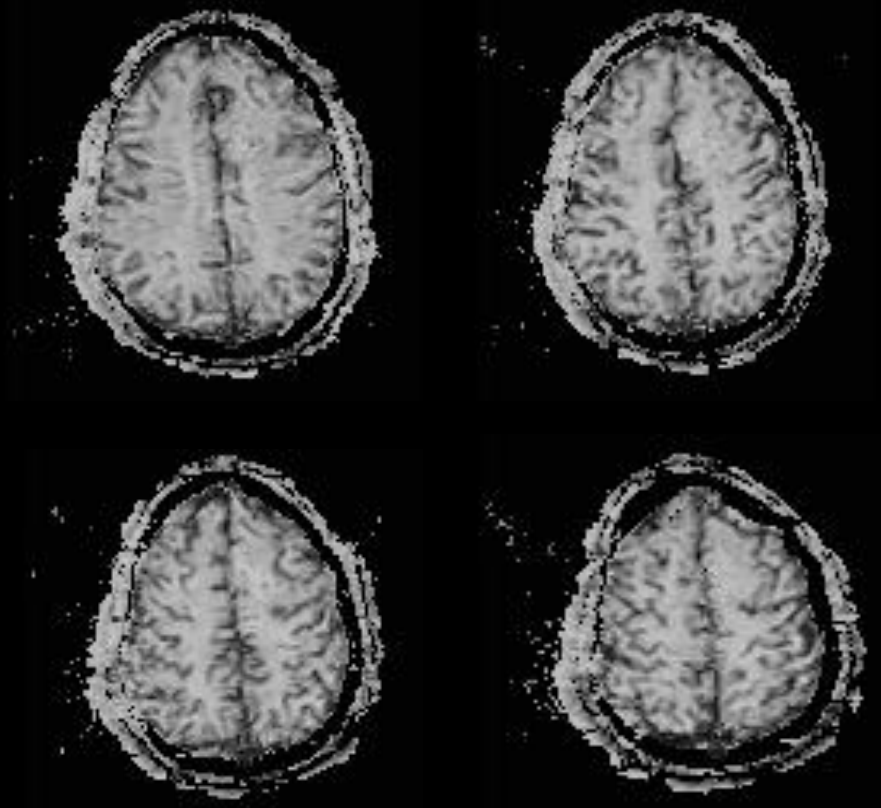
MR PERFUSION APPLICATIONS

Monitoring low-grade gliomas

CASE 1 - 41 Y.O. MALE, 3 SEIZURE-LIKE EPISODES

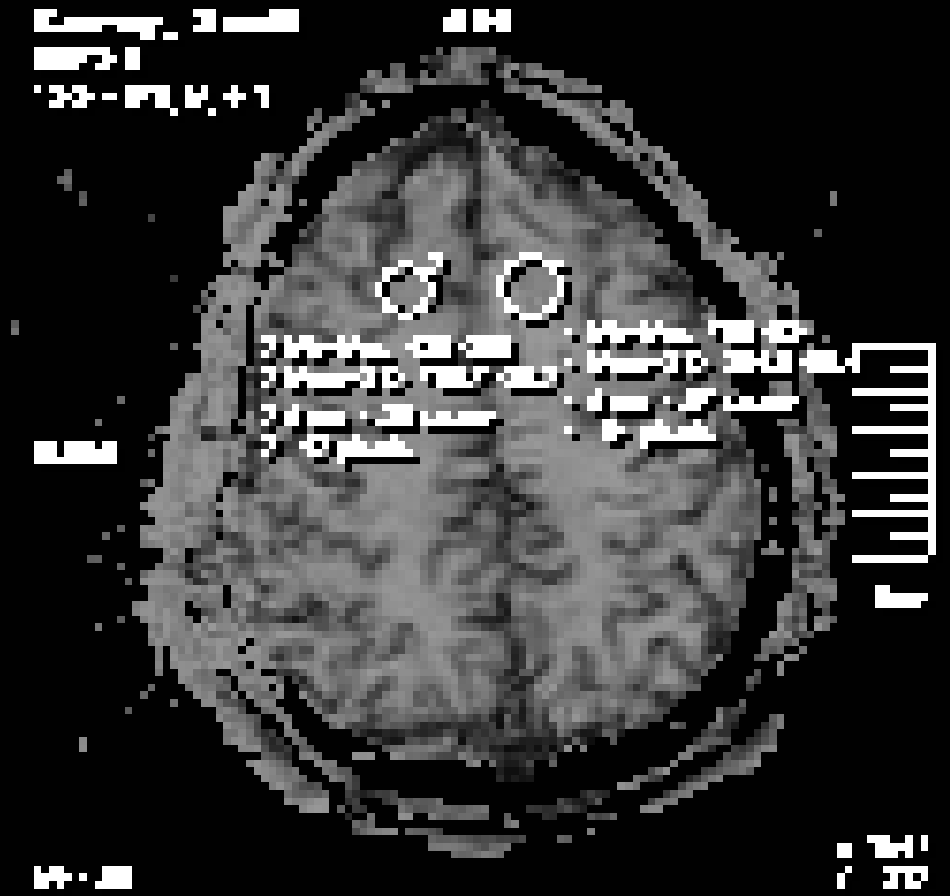




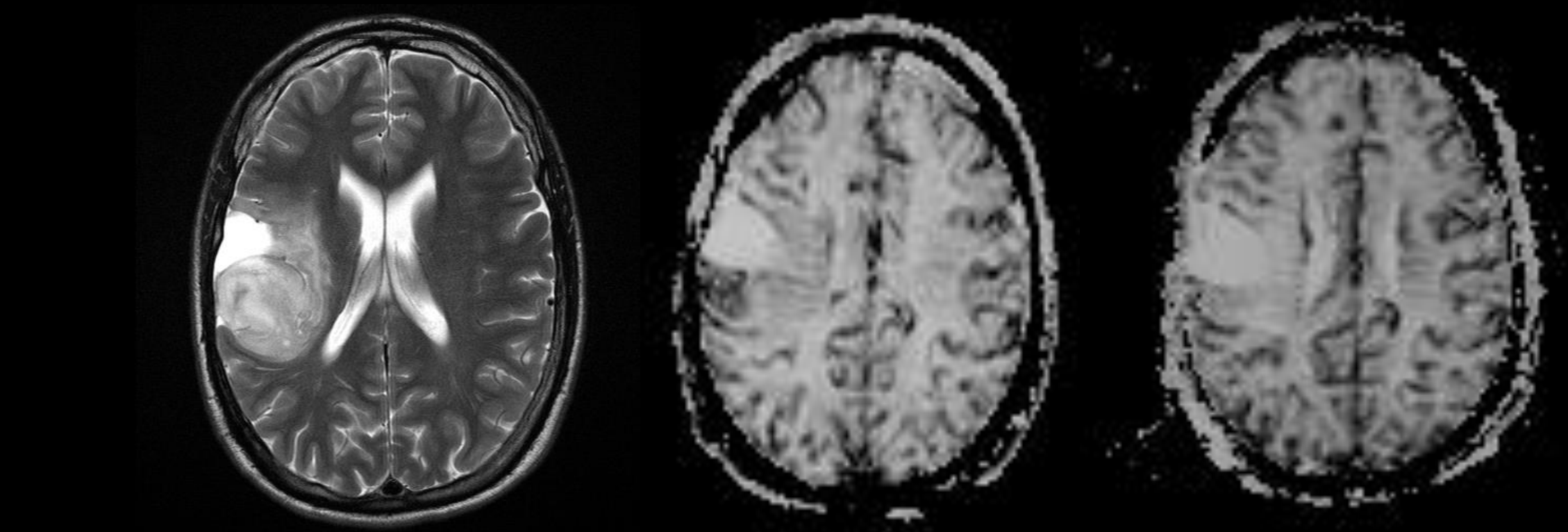


Grade II astrocytoma, +Del chromosome

rCBV 1.58



CASE 2 - 36 Y.O. OLIGODENDROGLIOMA RESECTED IN 1996



2006

2007

2011

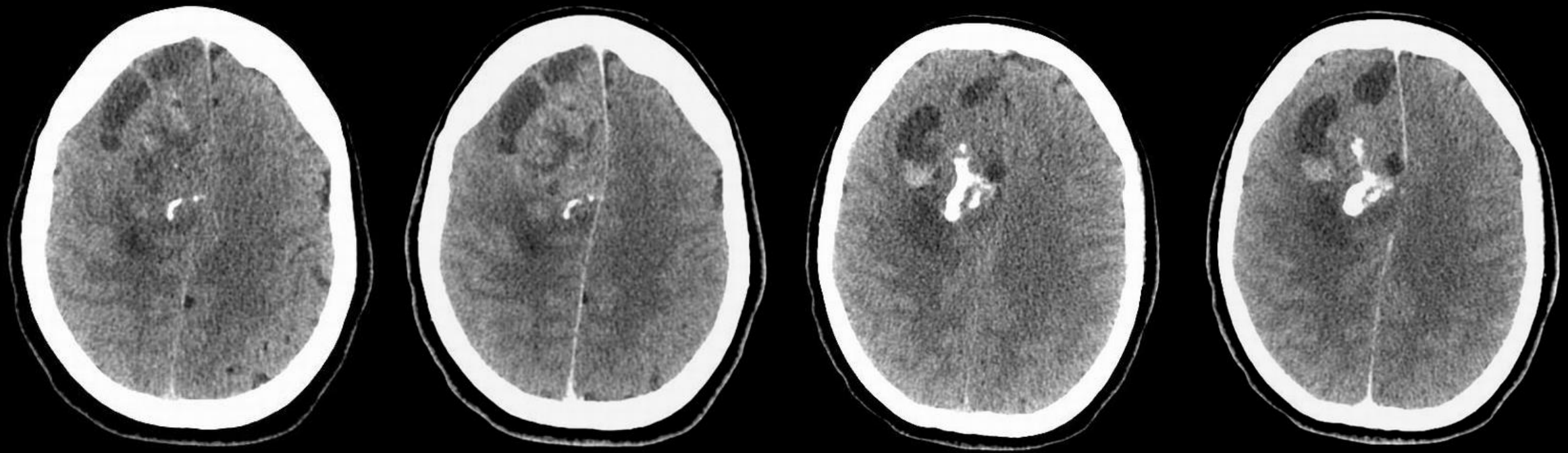
CASE 3

33 YEAR OLD FEMALE

AM HEADACHES FOR 3 WEEKS

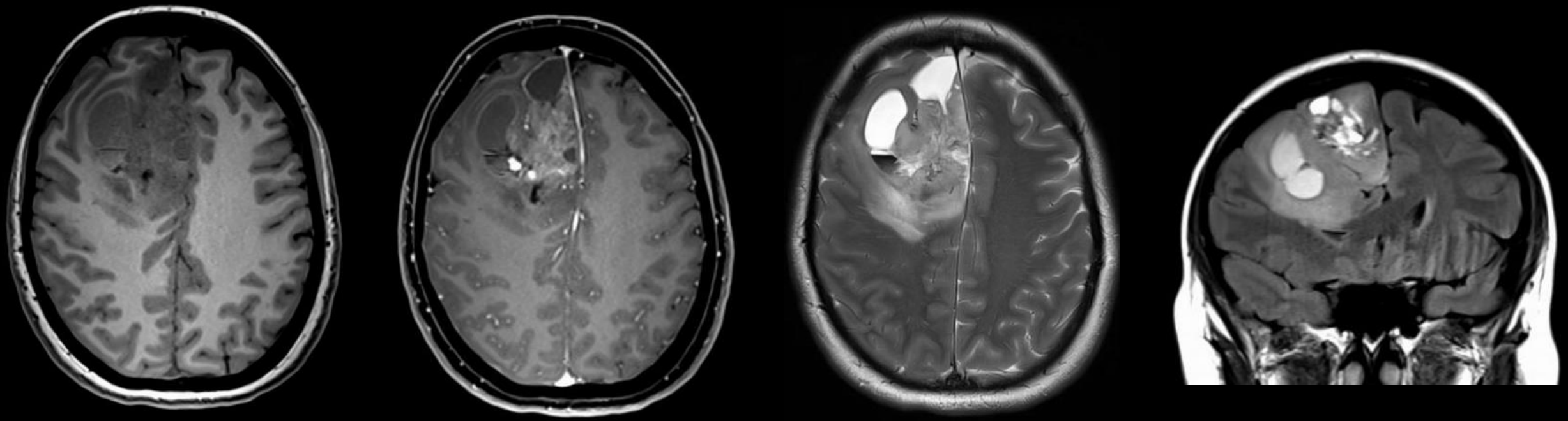
NAUSEA & VOMITING, VERTIGO

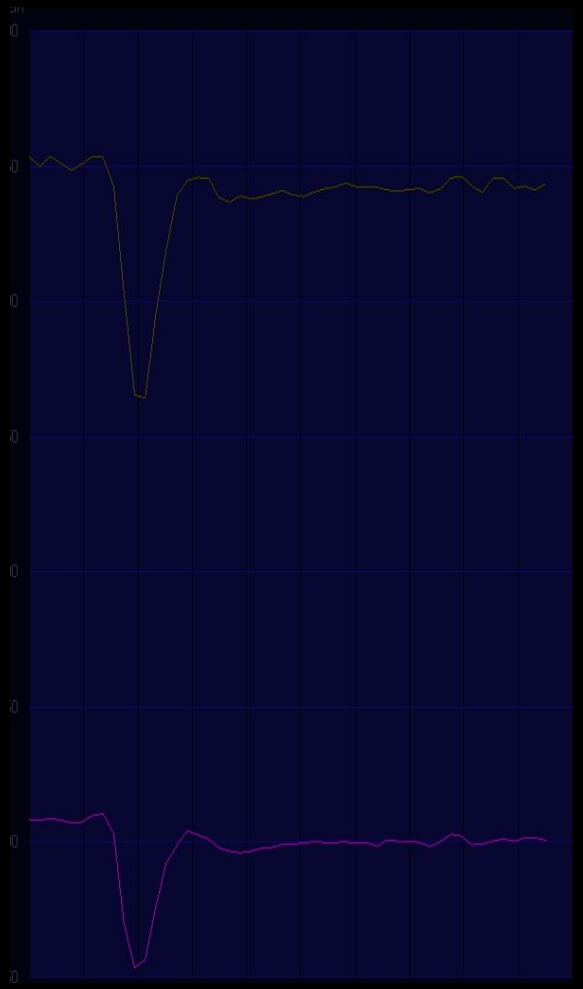
NO FOCAL NEUROLOGICAL DEFICITS

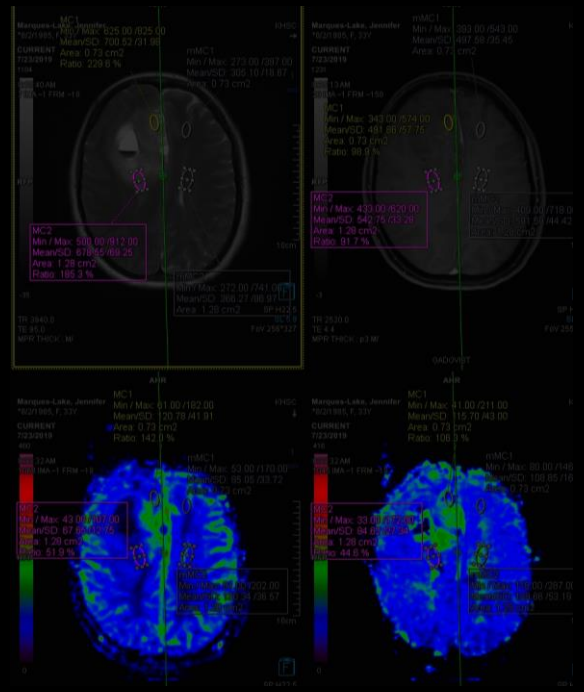


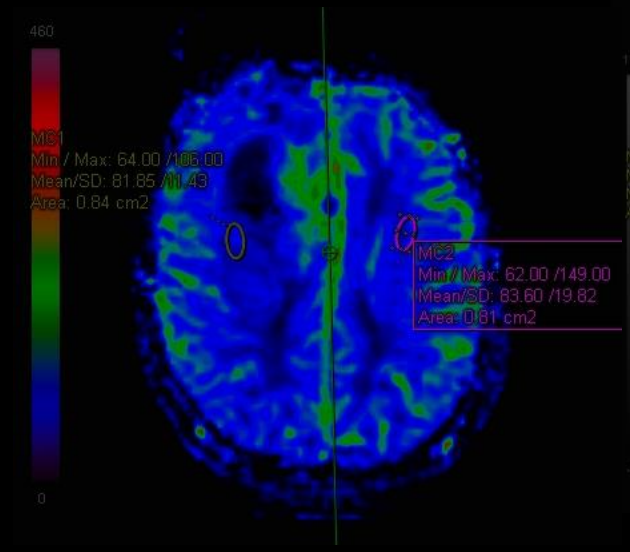
C– C+

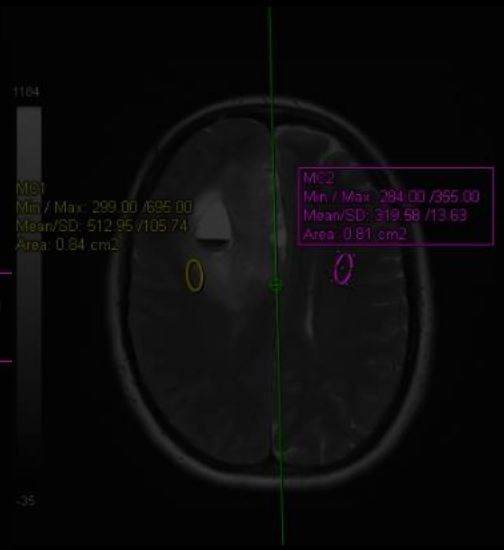
CASE 8








460
MC1
Min / Max: 64.00 /106.00
Mean/SD: 81.85 /11.43
Area: 0.84 cm2
MC2
Min / Max: 62.00 /149.00
Mean/SD: 83.60 /19.82
Area: 0.81 cm2

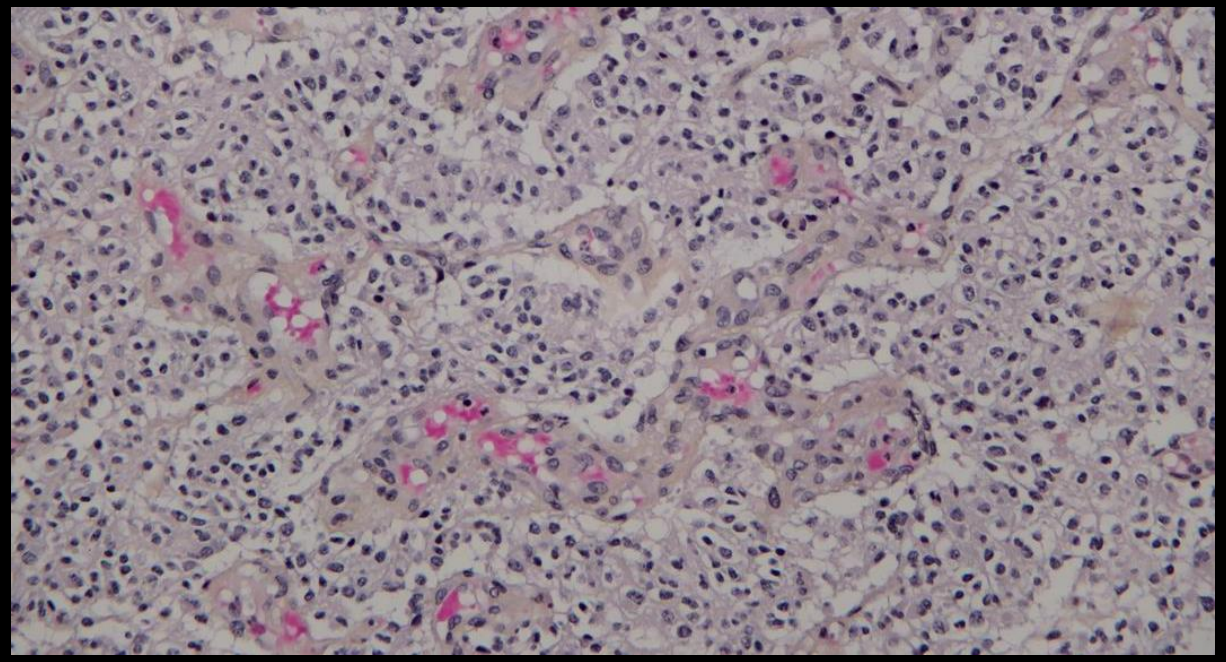

1184
MC1
Min / Max: 299.00 /695.00
Mean/SD: 512.95 /105.74
Area: 0.84 cm2
MC2
Min / Max: 284.00 /355.00
Mean/SD: 319.58 /13.63
Area: 0.81 cm2

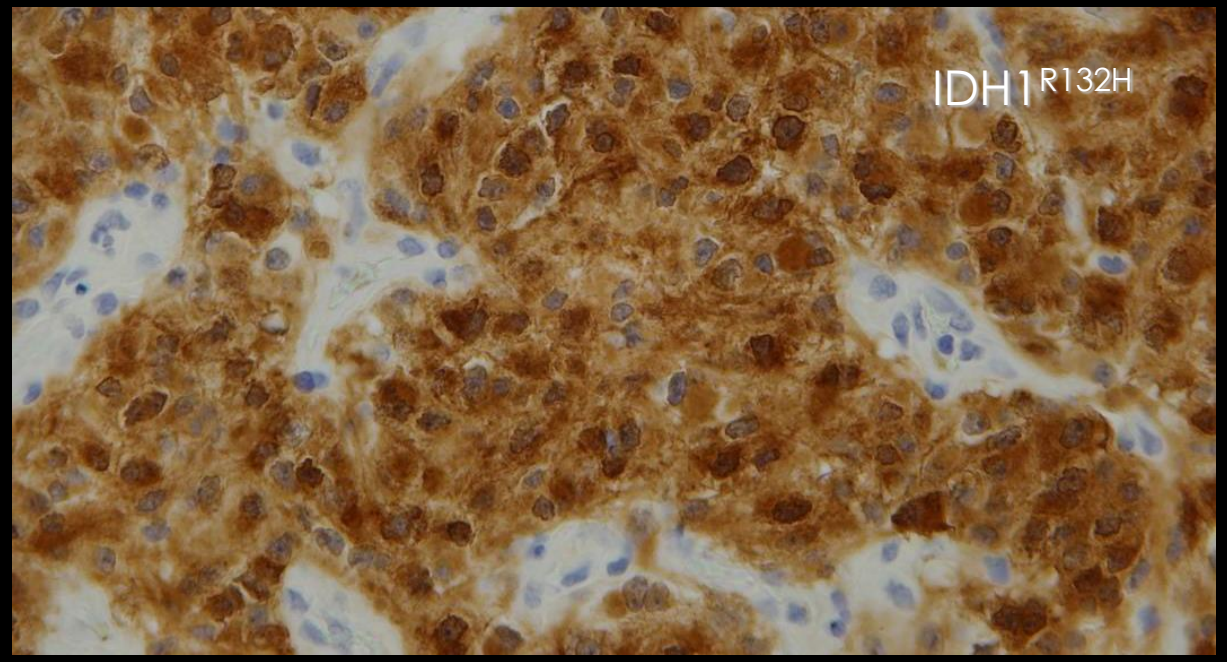
rCBV 1.6:1

OLIGODENDROGLIOMA, WHO GRADE II

IDH1^{R132H} MUTANT

1P/19Q CO-DELETED

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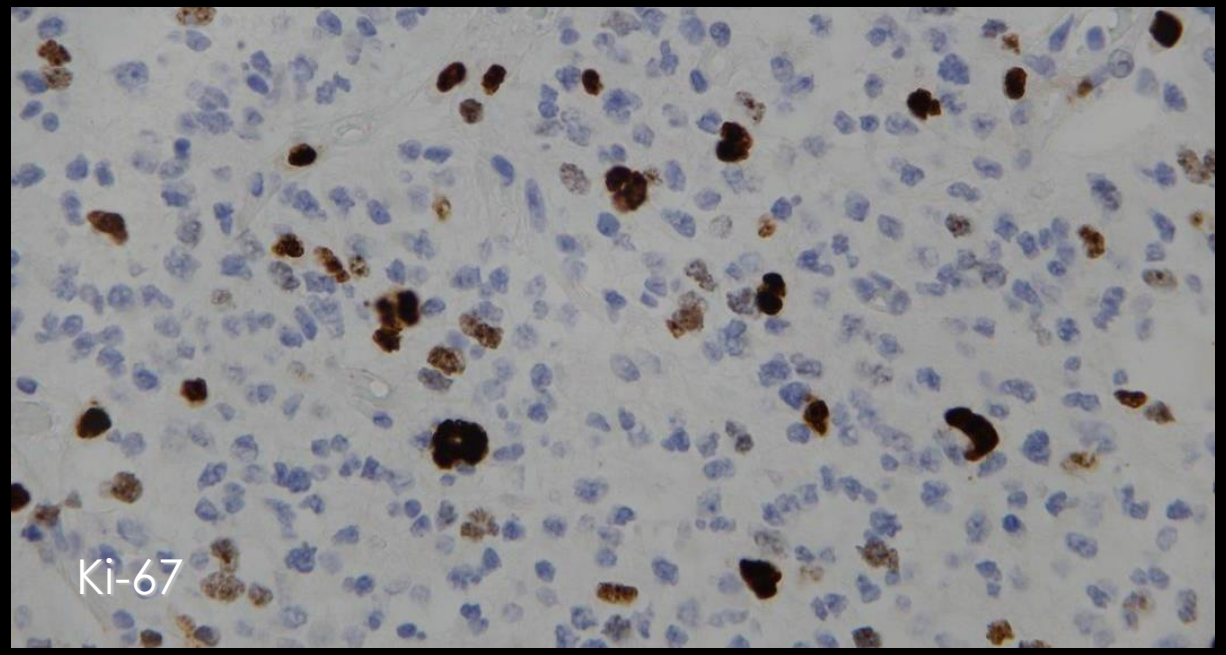
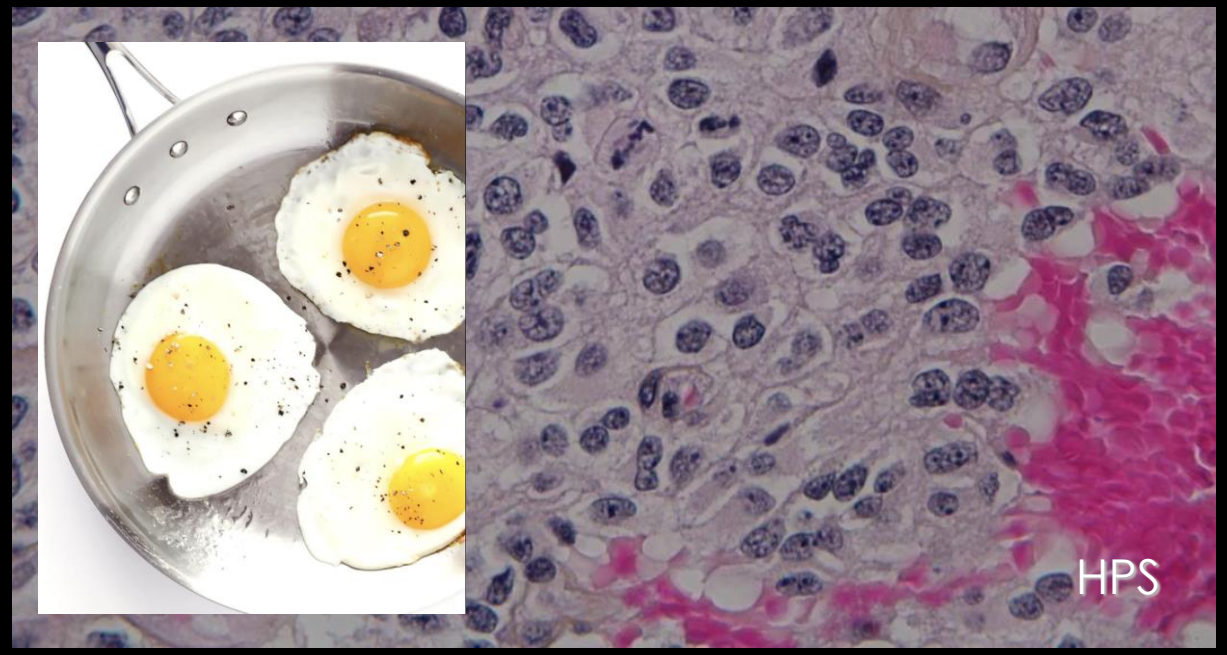

Ki-67


HPS

MR PERFUSION APPLICATIONS

Mapping boundaries

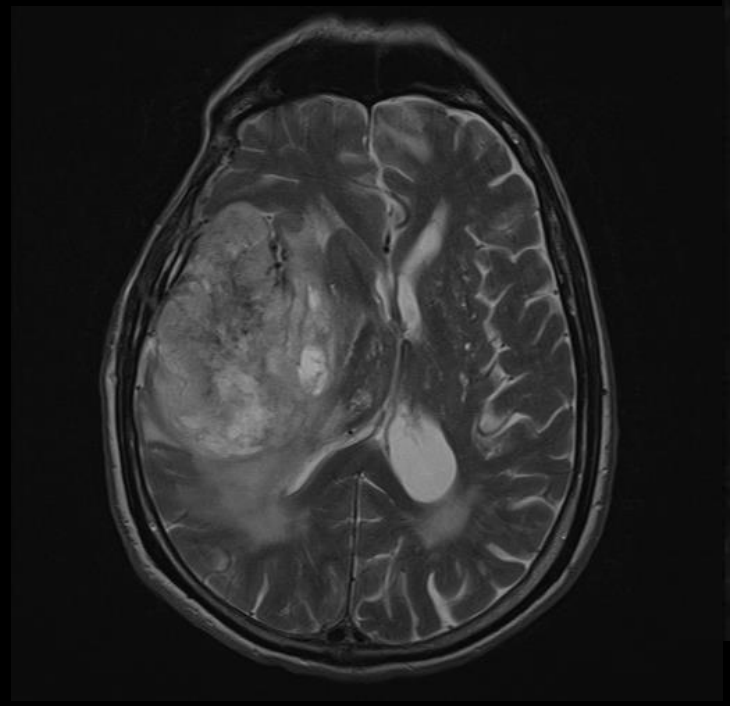
MAPPING BOUNDARIES

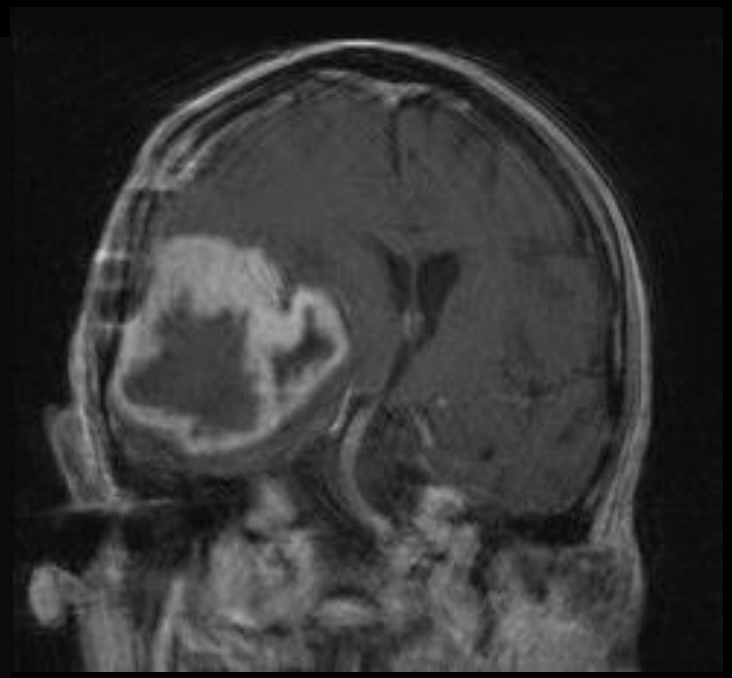
Biopsy of brain tumors is guided by either contrast-enhanced CT or MRI

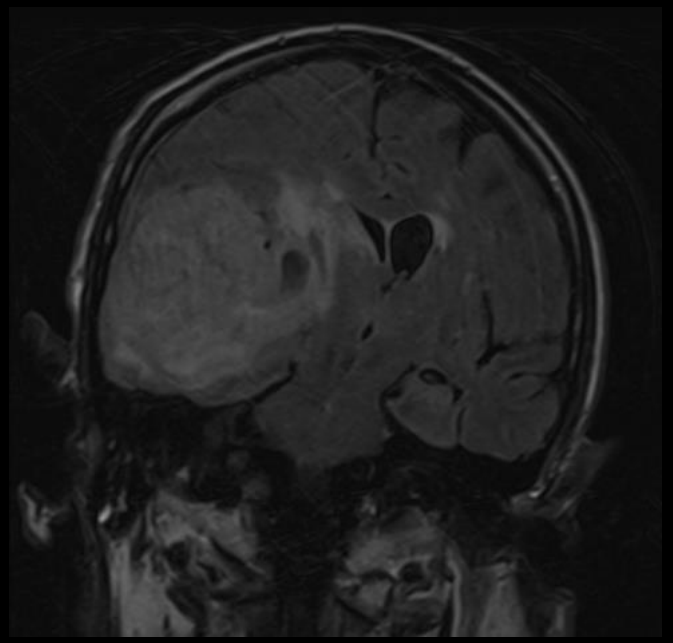
Sampling error is a major pitfall with this method because the most malignant portion of the tumor may not necessarily show contrast enhancement. 38% of anaplastic astrocytomas are not substantially enhancing; as many as 25% of brain tumors are likely undergraded as a result*

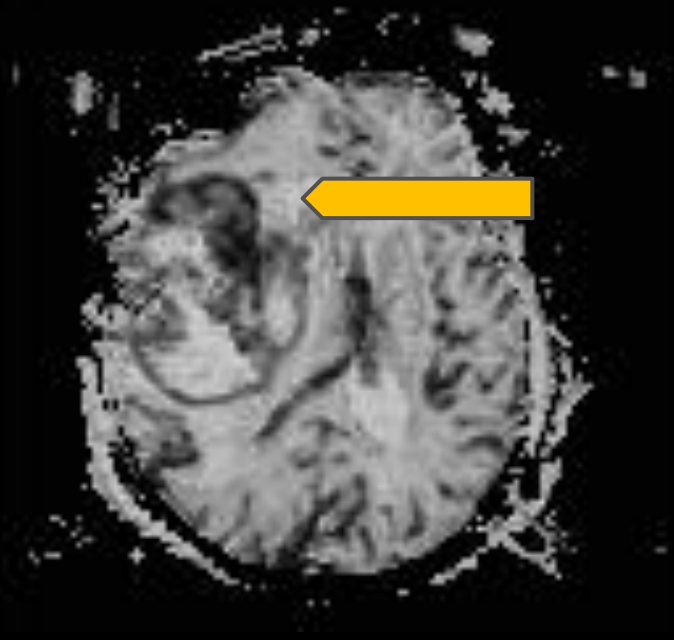
Relative CBV maps can be used to better select the highest-grade regions for biopsy targets of both enhancing and non-enhancing tumours**

CASE 1 – 79 YEAR-OLD MALE
BIOPSY GUIDANCE









Grade IV astrocytoma (GB); rCBV 7.5

MR PERFUSION APPLICATIONS

Monitoring high-grade gliomas

MR PERFUSION - MONITORING HIGH-GRADE GLIOMAS

New molecularly targeted anti-angiogenic drugs are being developed. PWI offers a method to monitor response to such chemotherapeutic agents

Earlier detection of tumour progression:

In one study of 59 patients, progression was detected by CBV maps an average of 4.5 months earlier than by MRI in 32%, an average of 4.5 months earlier than by TI-SPECT in 63%, and an average of 6.0 months earlier than clinical assessment in 55%*

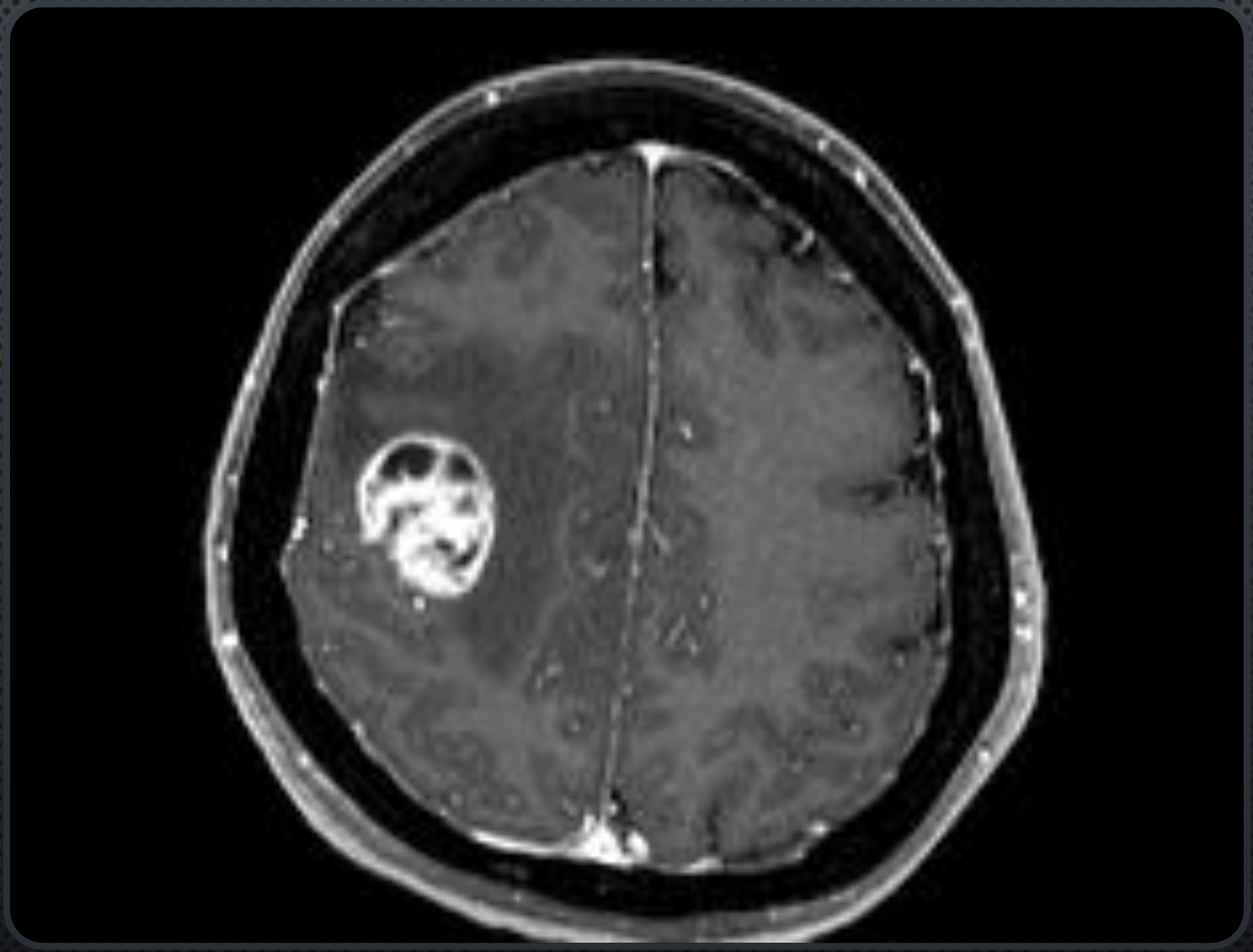
Sensitivity 50%, Specificity 90%. *AJNR Am. J. Neuroradiol*. 2000;21(5):901-909).

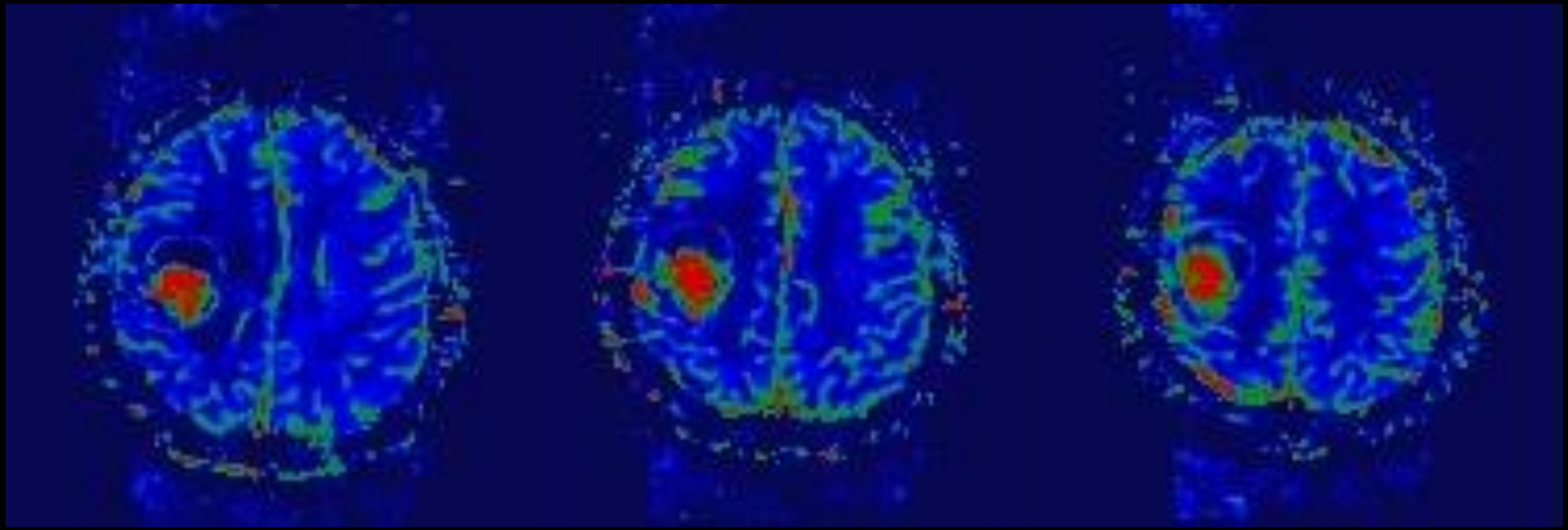
CASE 1

59 YEAR-OLD WOMAN

RAPIDLY DETERIORATING LUE AND LEE POWER – 2 MONTHS

FREQUENT FOCAL SEIZURES AND SECONDARY GENERALIZATION





rCBV ratio: 8.1:1

MR PERFUSION APPLICATIONS

Tumour progression versus Radiation Necrosis

TUMOUR PROGRESSION VERSUS RADIATION NECROSIS

- ***CRITICAL:***
  - VASTLY DIFFERENT MANAGEMENT STRATEGIES: FURTHER SURGERY AND CHEMOTHERAPY/RADIATION THERAPY VS. STEROIDS
  - CONVENTIONAL CONTRAST-ENHANCED MRI IS NOT RELIABLE FOR DIFFERENTIATING*
  - RELATIVE CBV APPEARS TO BE ELEVATED IN PATIENTS WITH RECURRENT TUMOUR, LIKELY REFLECTIVE OF THE INCREASED VASCULAR PROLIFERATION AND LEAKY CAPILLARIES OF RECURRENT TUMOUR
  - RELATIVE CBV IS DECREASED IN RADIATION NECROSIS DUE TO COMPOSED OF EXTENSIVE FIBRINOID NECROSIS, VASCULAR DILATATION, AND ENDOTHELIAL INJURY**

Kumar AJ, Leeds NE, Fuller GN, et al. Malignant gliomas: MR imaging spectrum of radiation therapy- and chemotherapy-induced necrosis of the brain after treatment. *Radiology* 2000; 217:377–384

TUMOUR PROGRESSION VERSUS RADIATION NECROSIS

- In a study of 20 patients after radiotherapy, an enhancing lesion with relative regional CBV ratios of higher than 2.6 indicates tumour recurrence, while ratios lower than 0.6 indicates therapy-related non-neoplastic contrast enhancement

- Sensitivity 50%, specificity 90%

AJNR Am. J. Neuroradiol. 2000;21(5):901-909.

TUMOUR PROGRESSION VERSUS RADIATION NECROSIS

AJNR
AMERICAN JOURNAL OF NEURORADIOLOGY

Research Article | ADULT BRAIN

Utility of Dynamic Susceptibility Contrast Perfusion-Weighted MR Imaging and ^{11}C-Methionine PET/CT for Differentiation of Tumor Recurrence from Radiation Injury in Patients with High-Grade Gliomas

Z. Qiao, X. Zhao, K. Wang, Y. Zhang, D. Fan, T. Yu, H. Shen, Q. Chen and L. Ai

American Journal of Neuroradiology January 2019, DOI: https://doi.org/10.3174/ajnr.A5952

Table 3:

Results of semiquantitative analysis of MET PET/CT and PWI parameters for the differentiation of recurrence from radiation injury in patients with HGGs

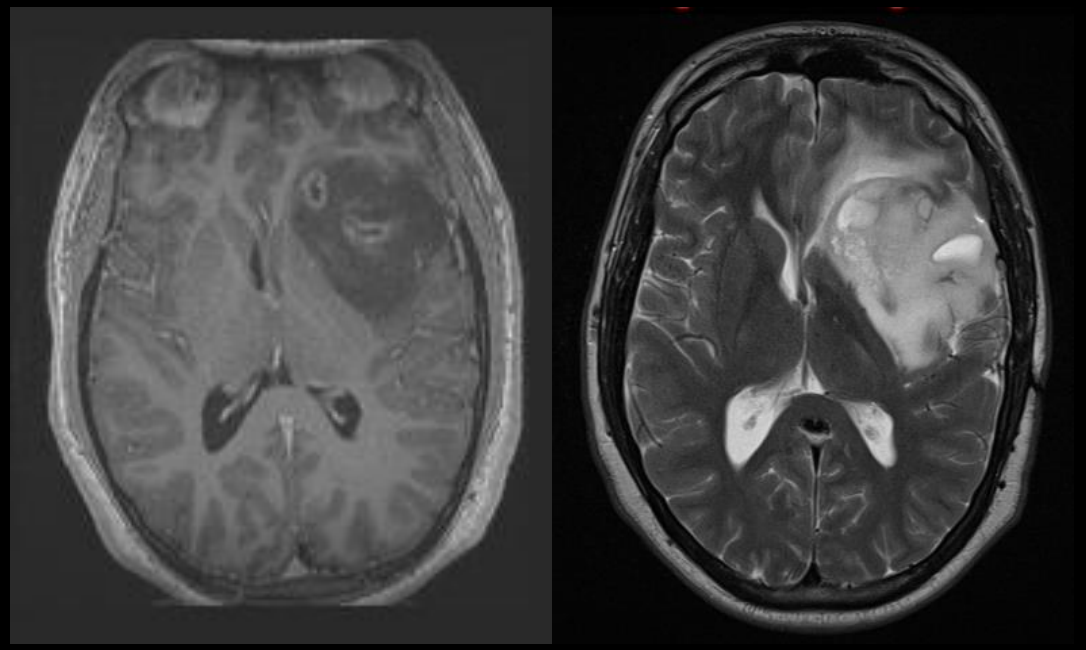
	Final Diagnosis		*P* Value[a]
	Recurrence	Radiation Injury	
SUV_{max}	5.10 ± 2.41	2.41 ± 1.67	.003
SUV_{mean}	2.83 ± 1.27	1.39 ± 0.9	.003
$TBRSUV_{max}$	3.48 ± 1.17	1.96 ± 0.96	.003
$rCBV_{mean}$	2.68 ± 1.14	1.33 ± 0.77	.004

[a] All *P* values for discrimination between recurrence and radiation injury are significant.

CBV
2.68

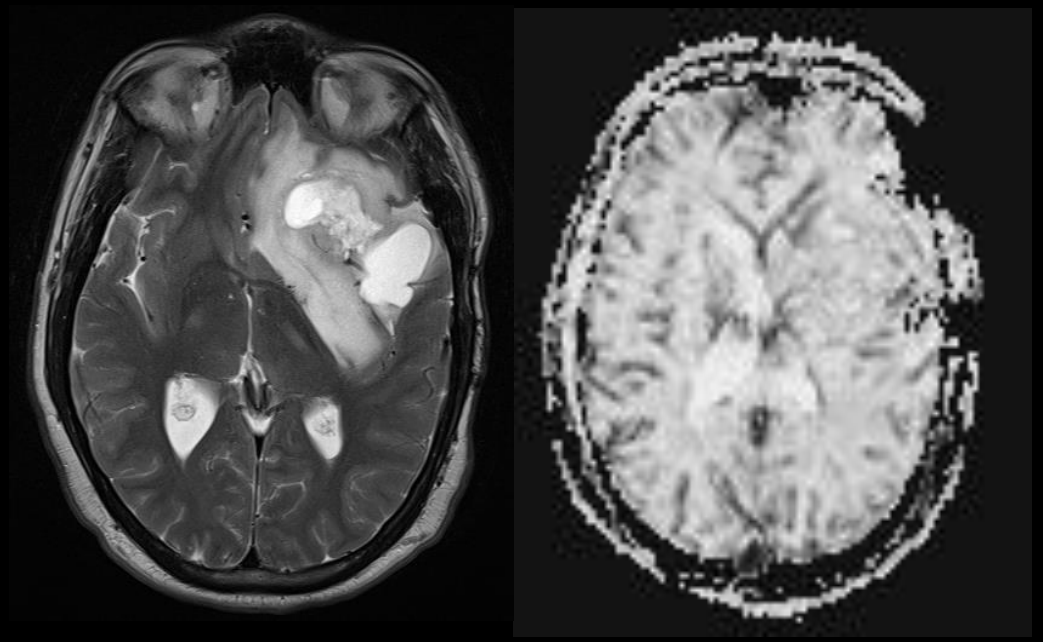
CBV
1.33

CASE 1 - 23 YEAR-OLD, RIGHT HAND TREMOR



2009

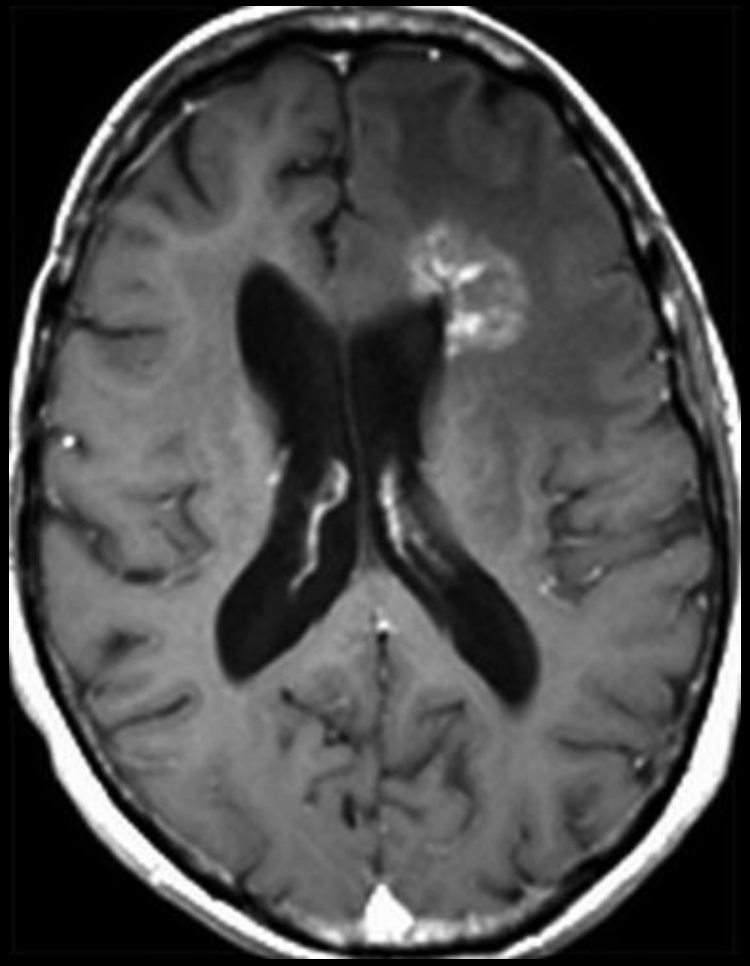
Grade II oligo, -Del

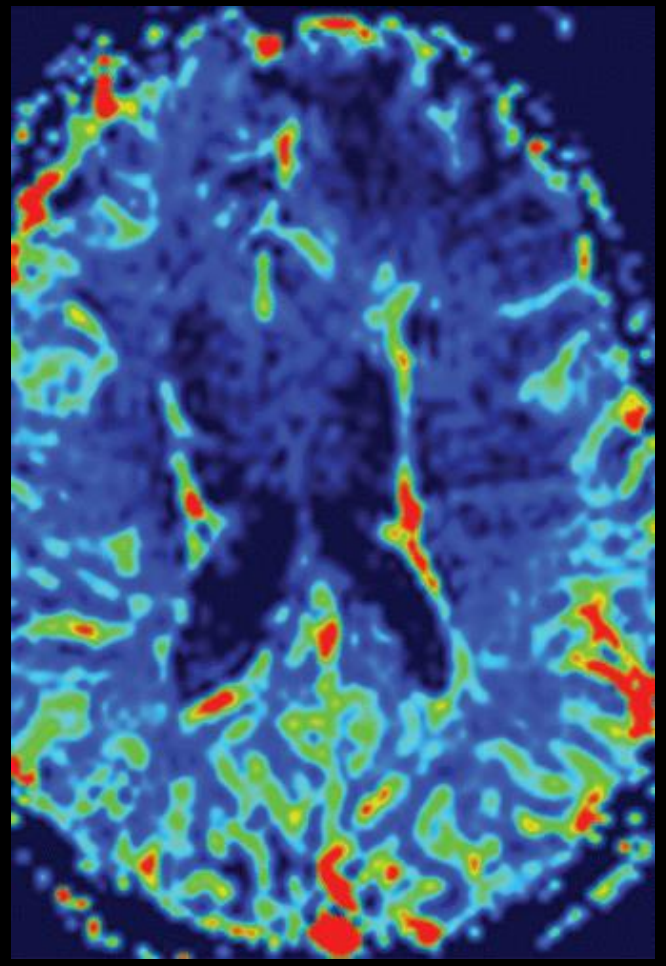


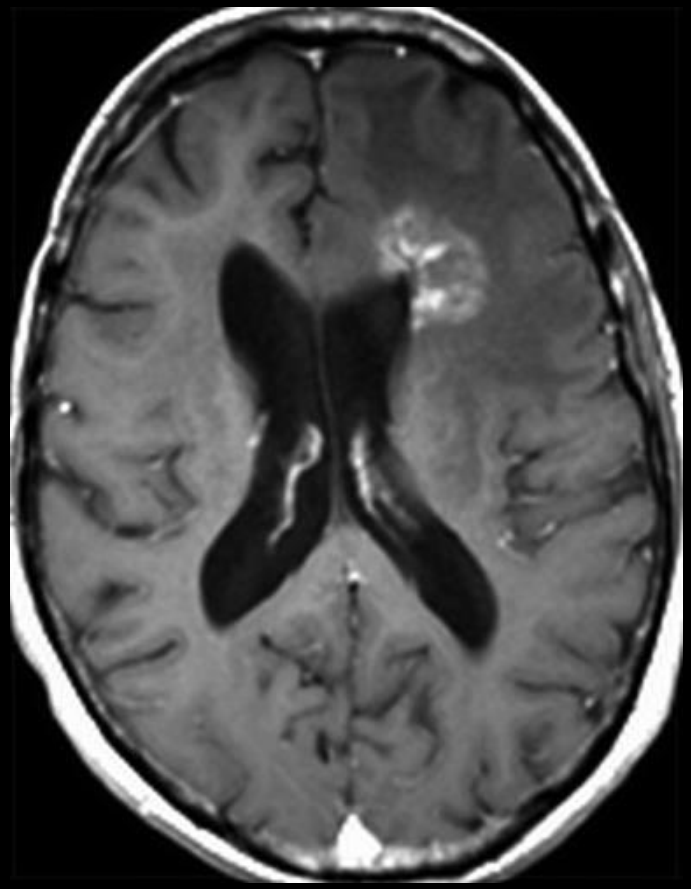
May 2011

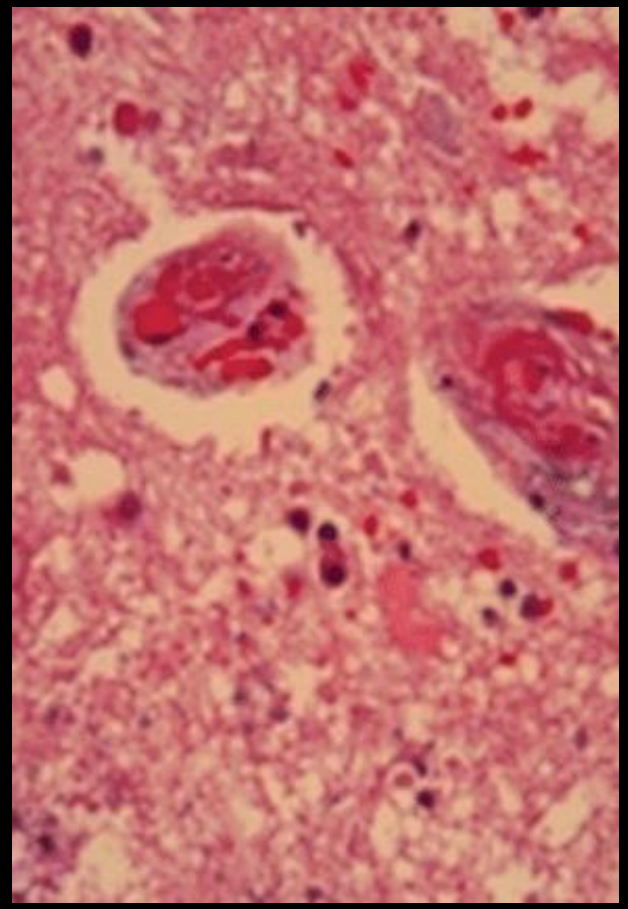
Radiation Necrosis

CASE 2 – 2 YEARS AFTER THERAPY: PROGRESSIVE HEADACHE, CONFUSION, BEHAVIORAL CHANGES









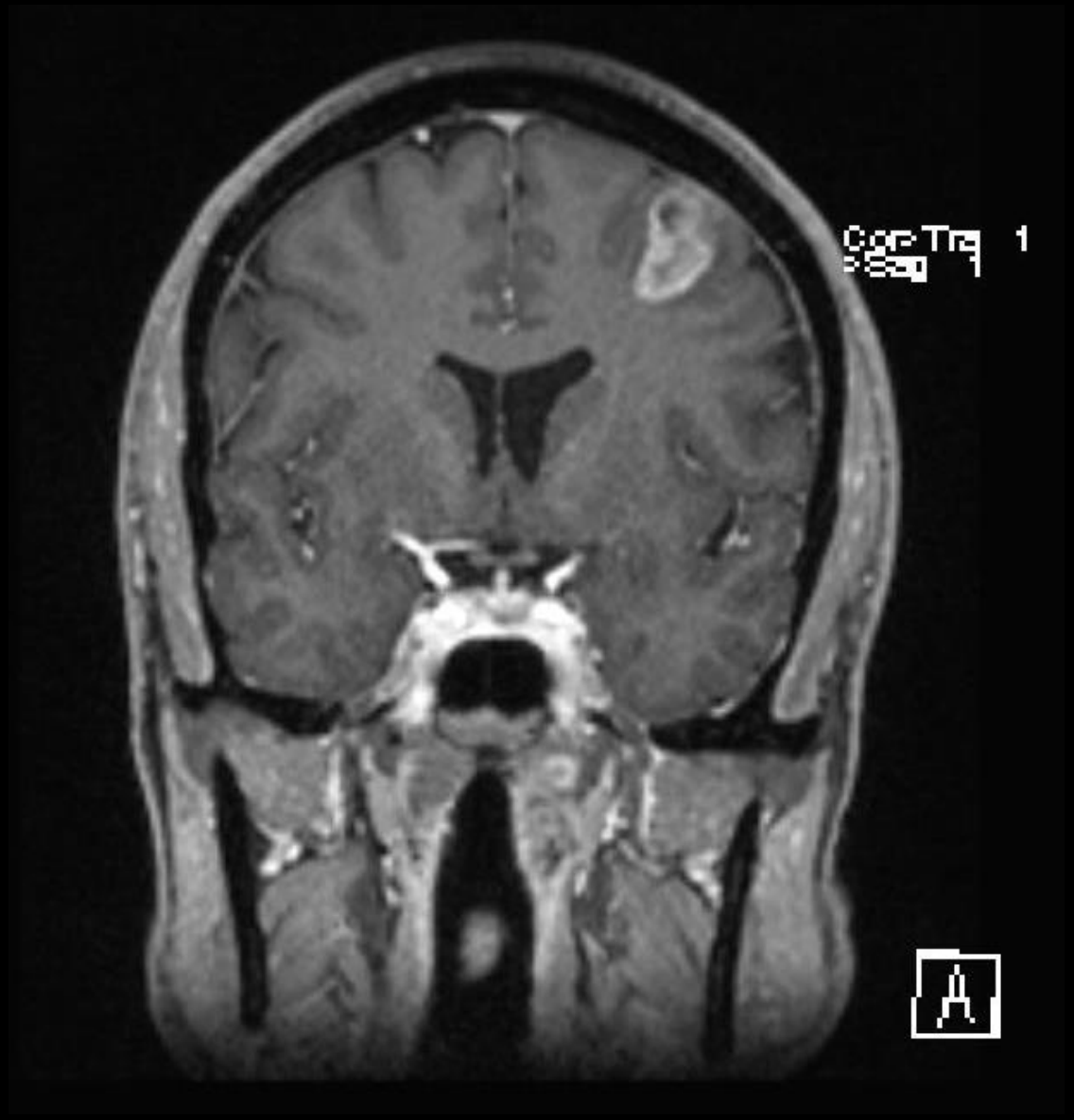
PATHOLOGY:

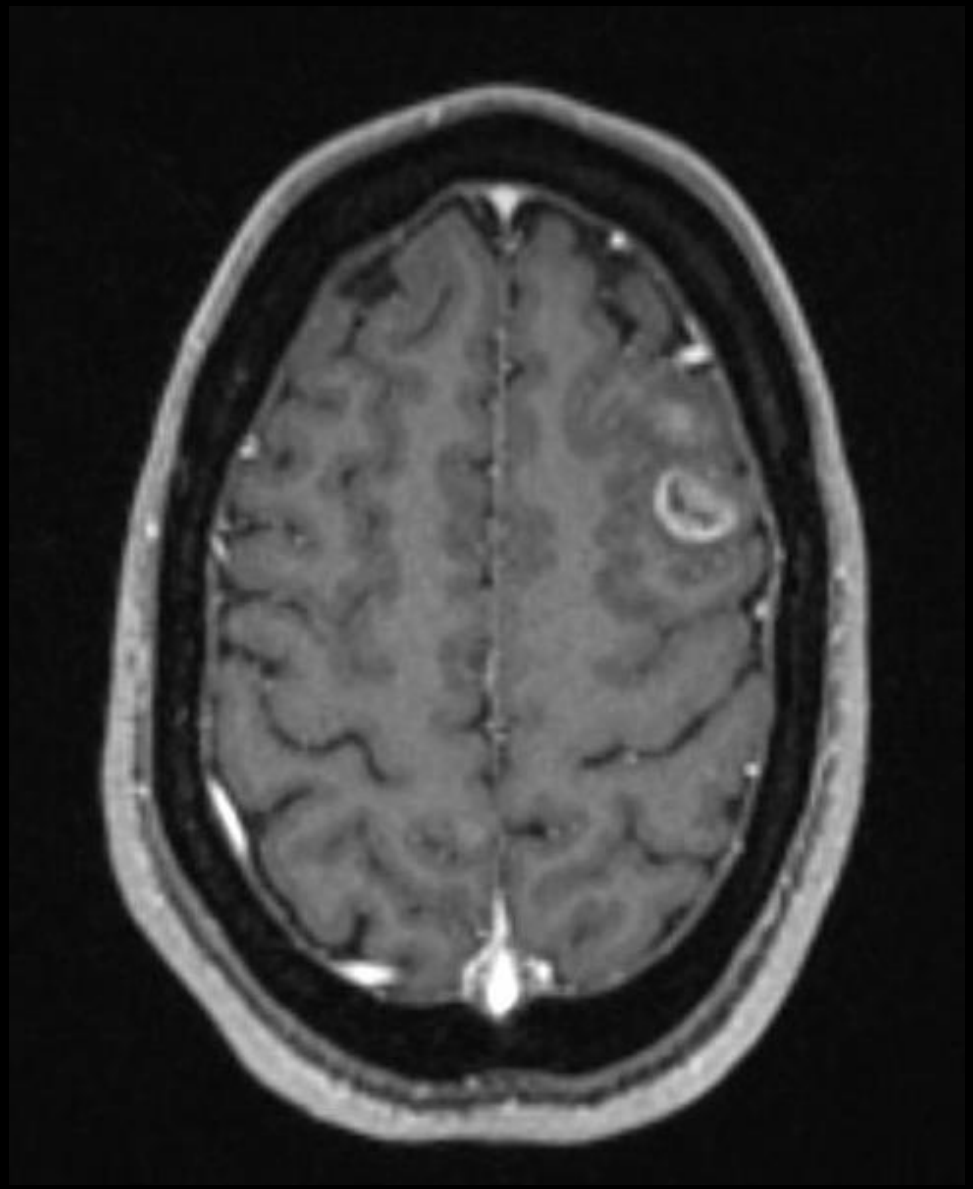
TYPICAL FEATURES OF COAGULATION NECROSIS WITH PROFOUND VASCULAR CHANGES, INCLUDING FIBRINOID NECROSIS AND HYALINIZATION OF WALL AND OCCLUSION OF LUMINA BY FIBRIN THROMBI.

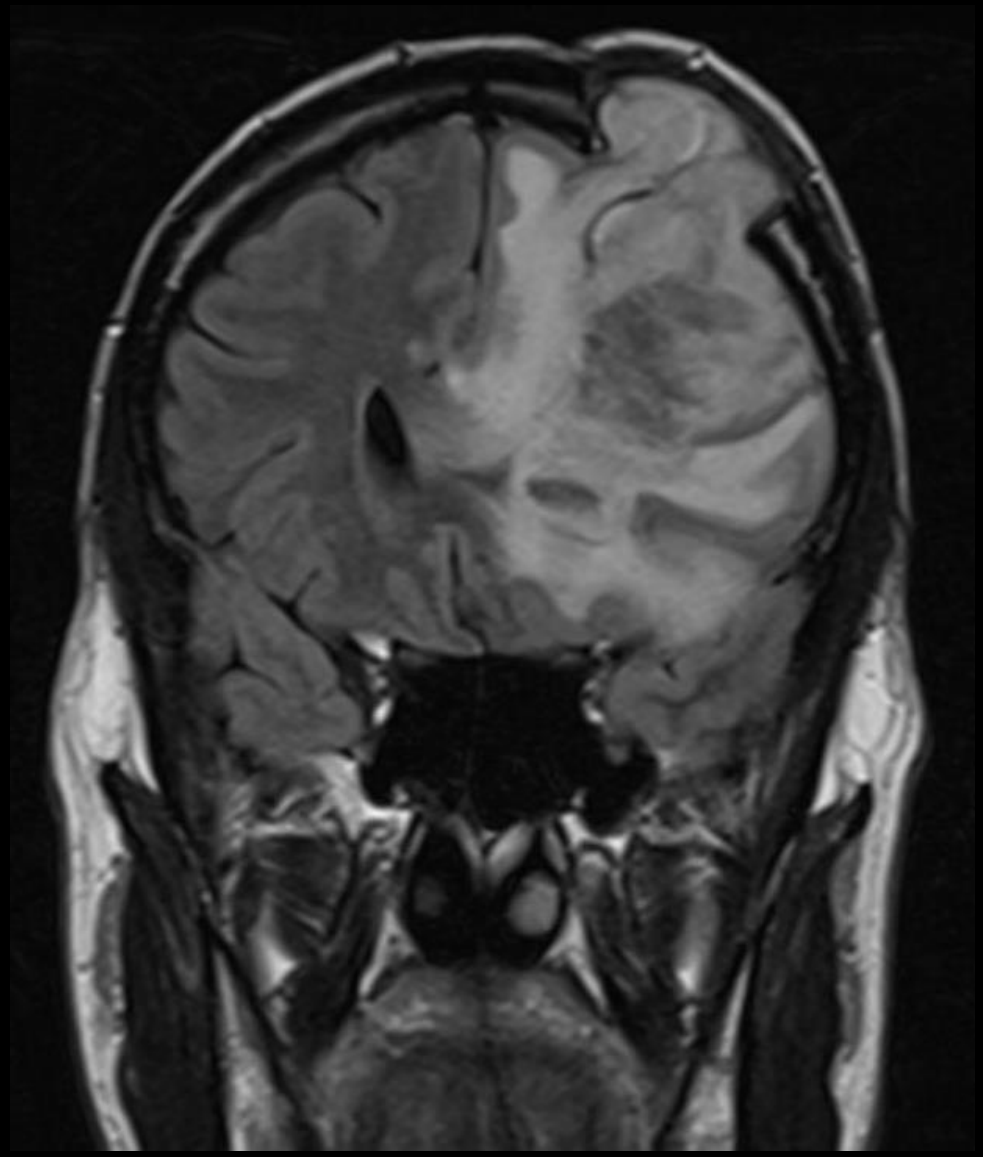
CASE 4

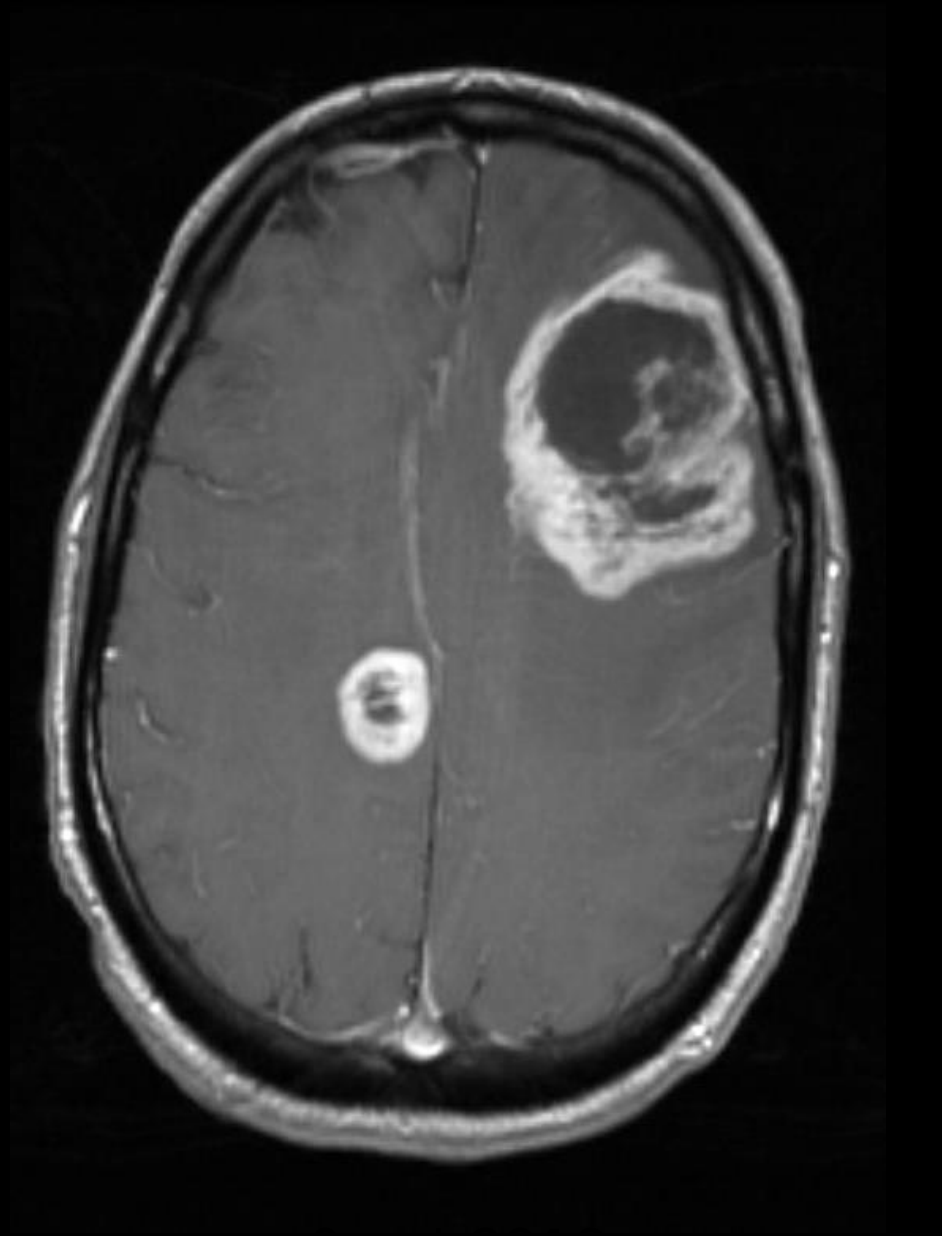
51 YEAR-OLD MALE

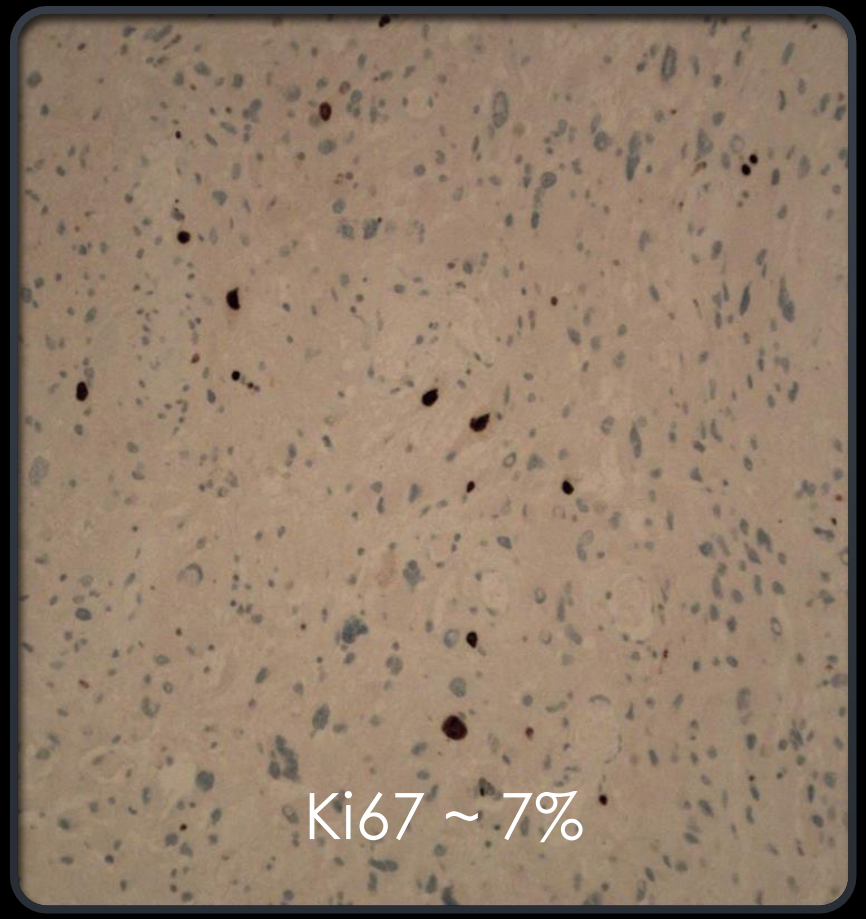
SEIZURE

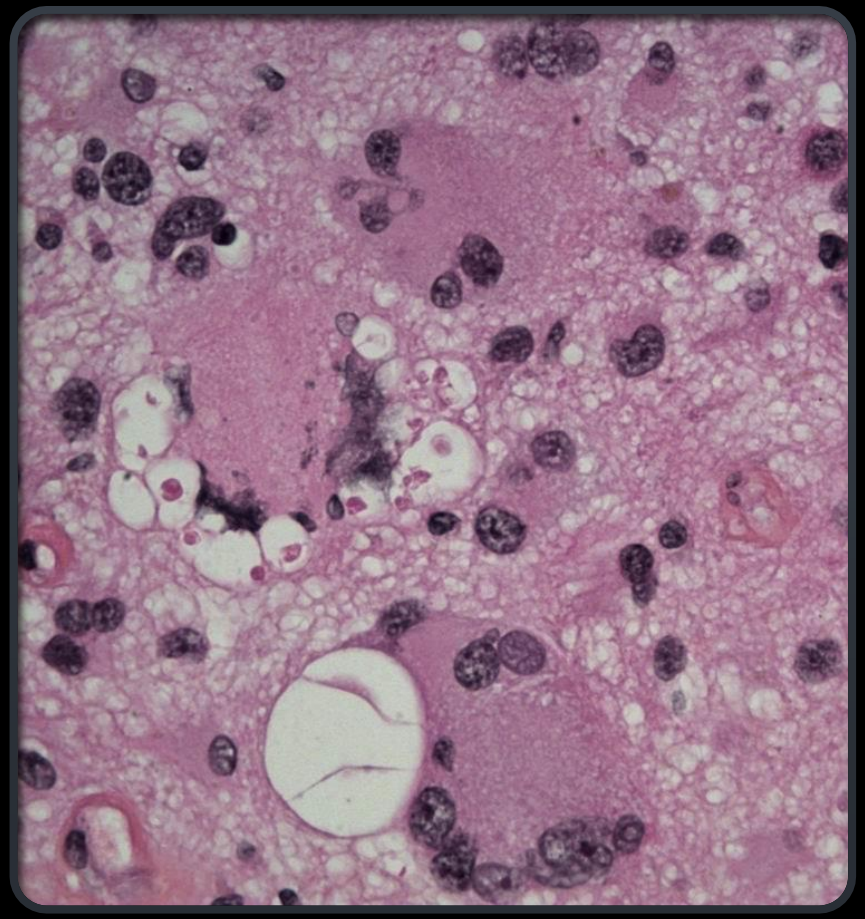












GLIOBASTOMA – WITH EXTENSIVE RADIATION-TYPE NECROSIS

DECREASED TUMOUR CELL PROLIFERATION

VACUOLIZATION WITH CYSTIC CHANGE

MR PERFUSION – UTILITY

ORIGINAL RESEARCH

Does MR Perfusion Imaging Impact Management Decisions for Patients with Brain Tumors? A Prospective Study

C.P. Geer
J. Simonds
A. Anvery
M.Y. Chen
J.H. Burdette
M.E. Zapadka
T.L. Ellis
S.B. Tatter
G.J. Lesser
M.D. Chan
K.P. McMullen
A.J. Johnson

FELLOWS' JOURNAL CLUB

BACKGROUND AND PURPOSE: MR perfusion imaging can be used to help predict glial tumor grade and disease progression. Our purpose was to evaluate whether perfusion imaging has a diagnostic or therapeutic impact on clinical management planning in patients with glioma.

MATERIALS AND METHODS: Standard MR imaging protocols were interpreted by a group of 3 NRs in consensus, with each case being interpreted twice: first, including routine sequences; and second, with the addition of perfusion imaging. A multidisciplinary team of treating physicians assessed tumor status and created hypothetical management plans, on the basis of clinical presentation and routine MR imaging and then routine MR imaging plus perfusion MR imaging. Physicians' confidence in the tumor status assessment and management plan was measured by using Likert-type items.

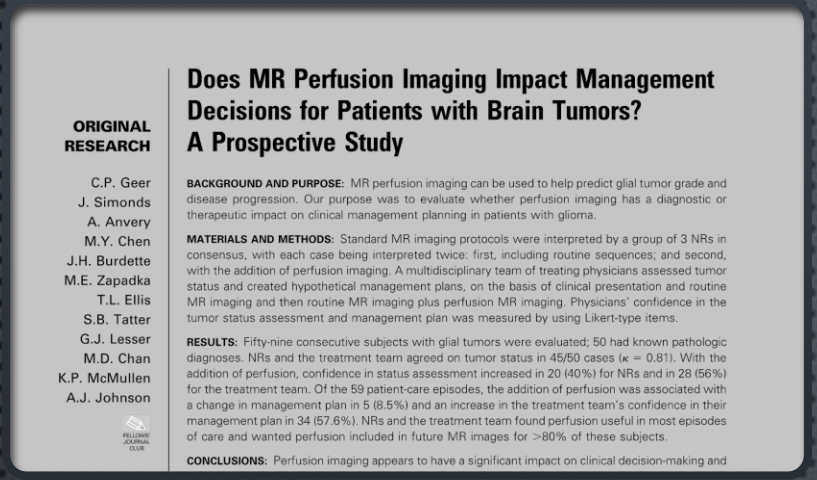
RESULTS: Fifty-nine consecutive subjects with glial tumors were evaluated; 50 had known pathologic diagnoses. NRs and the treatment team agreed on tumor status in 45/50 cases ($\kappa = 0.81$). With the addition of perfusion, confidence in status assessment increased in 20 (40%) for NRs and in 28 (56%) for the treatment team. Of the 59 patient-care episodes, the addition of perfusion was associated with a change in management plan in 5 (8.5%) and an increase in the treatment team's confidence in their management plan in 34 (57.6%). NRs and the treatment team found perfusion useful in most episodes of care and wanted perfusion included in future MR images for >80% of these subjects.

CONCLUSIONS: Perfusion imaging appears to have a significant impact on clinical decision-making and subspecialist physicians' confidence in management plans for patients with brain tumor.

ABBREVIATIONS: ASL = arterial spin-labeled; COE = Center of Excellence; DSC = dynamic susceptibility contrast; GBM = glioblastoma multiforme; NR = neuroradiologist; PASL = pulsed arterial spin-labeling; ROC = receiver operating characteristic; SPGR = spoiled gradient-recalled

"Perfusion imaging appears to have a significant impact on clinical decision-making and subspecialist physicians' confidence in management plans for patients with brain tumor."

C.P. Geer et al. AJNR Am J Neuroradiol 2012;33:556-562



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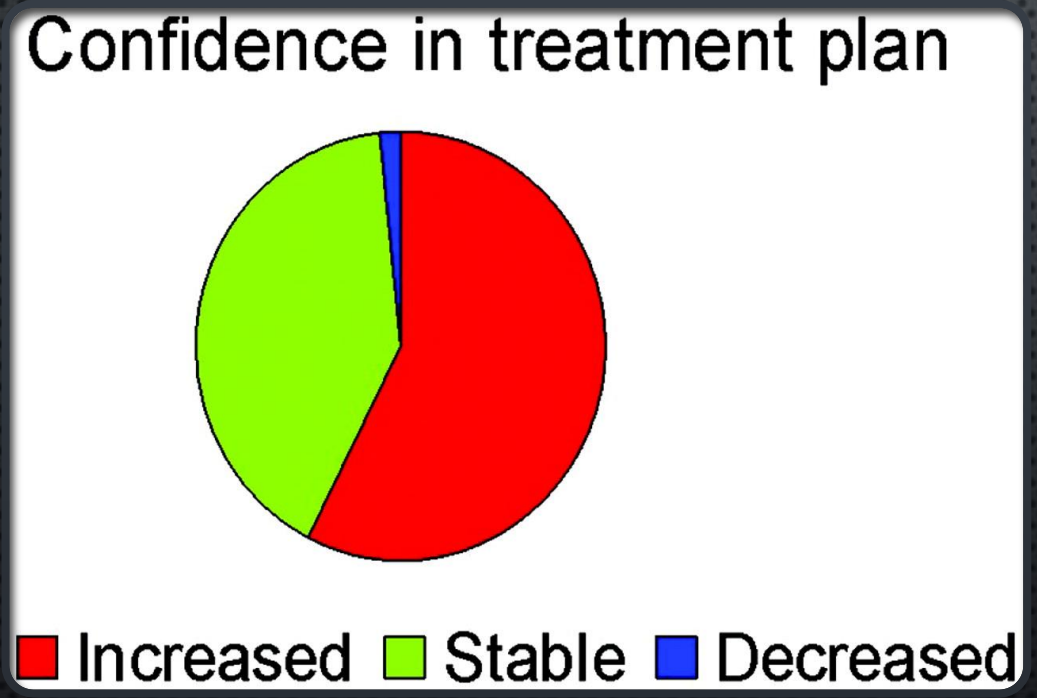

MR PERFUSION - CONFIDENCE

"Perfusion imaging appears to have a significant impact on clinical decision-making and subspecialist physicians' confidence in management plans for patients with brain tumor."

AJNR
AMERICAN JOURNAL OF NEURORADIOLOGY

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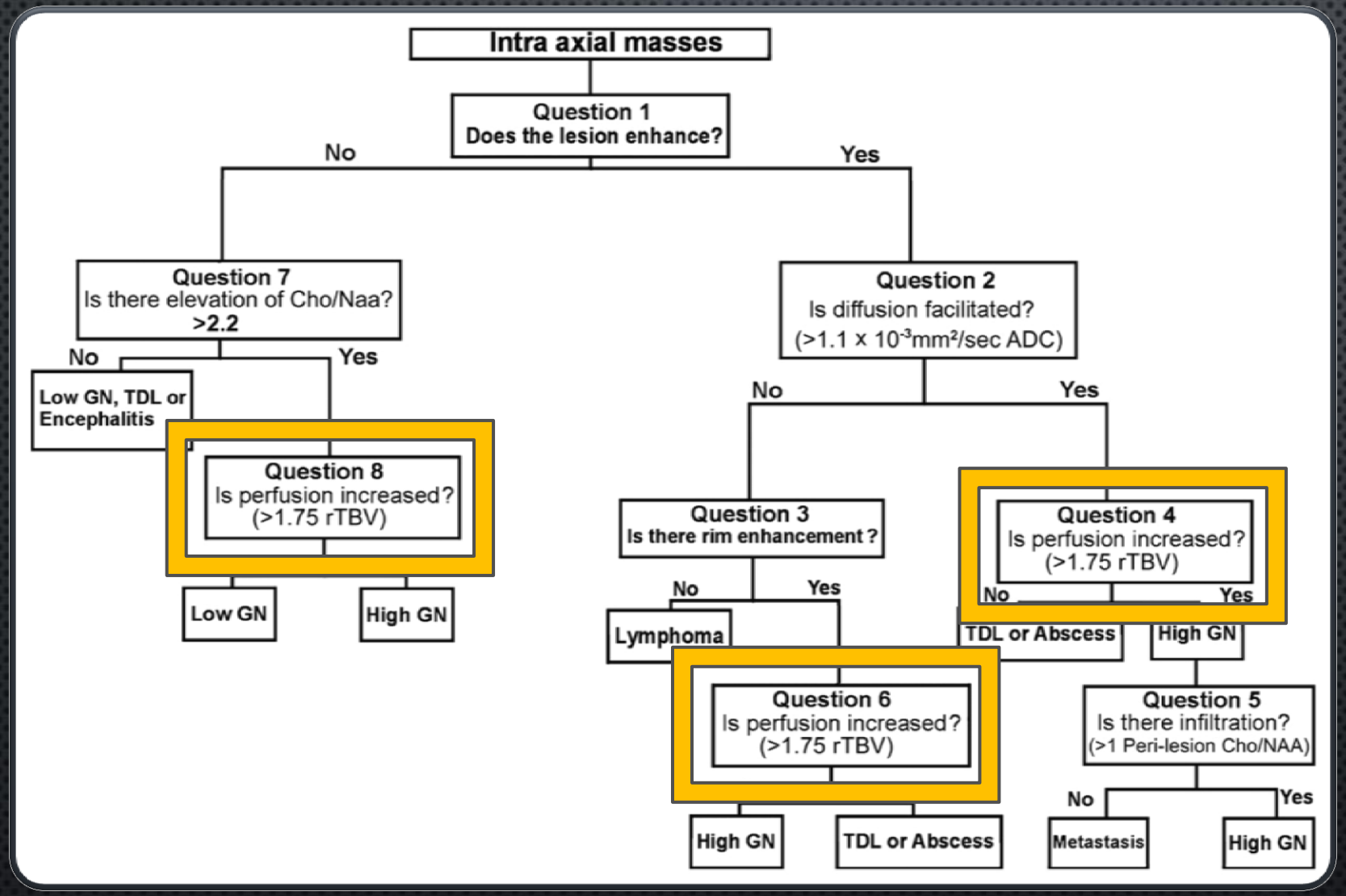
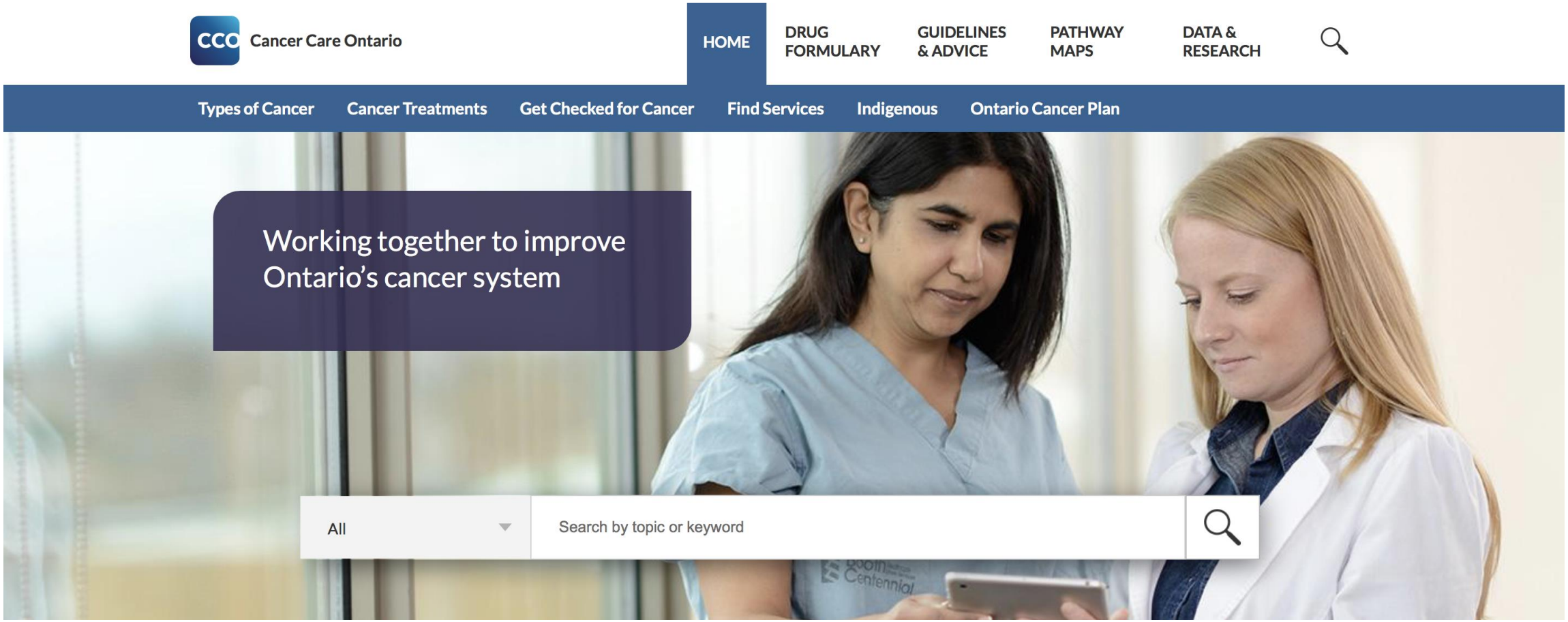


BRAIN TUMOUR

DIAGNOSTIC ALGORITHM

RadioGraphics

Al-Okaili R N et al. Radiographics 2006;26:S173-S189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Pathway Maps

Breast Cancer Pathway Map

MAR 2018

This pathway map provides an overview of the evidence-based best practices for the management of breast cancer patients in Ontario, across all phases...

Pathway Map

Cervical Cancer Pathway Map

Pathway Map

Lung Cancer Pathway Map

Pathway Map

Thyroid Cancer Pathway Map

Pathway Map

Colorectal Cancer Pathway Map

Pathway Map

Ovarian Cancer Pathway Map

Pathway Map

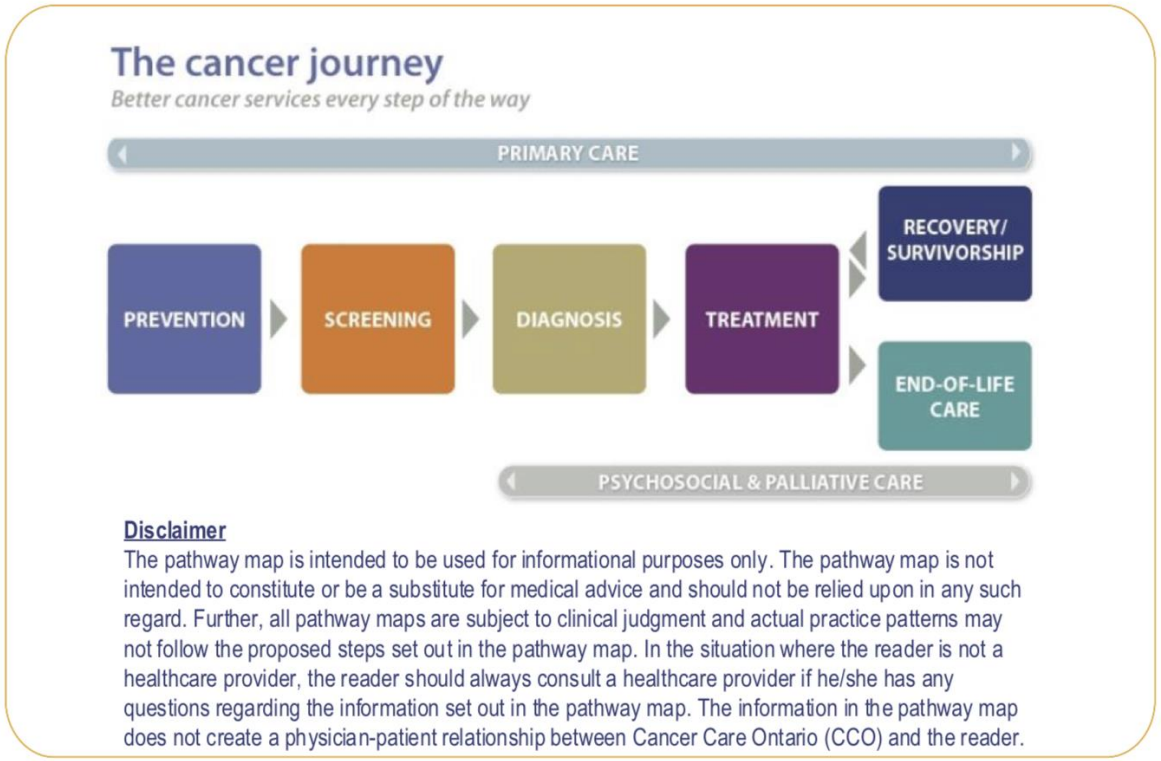
Prostate Cancer Pathway Map

Pathway Map

Bladder Cancer Pathway Map

Oropharyngeal Squamous Cell Cancer Diagnosis Pathway Map

Version 2019.09



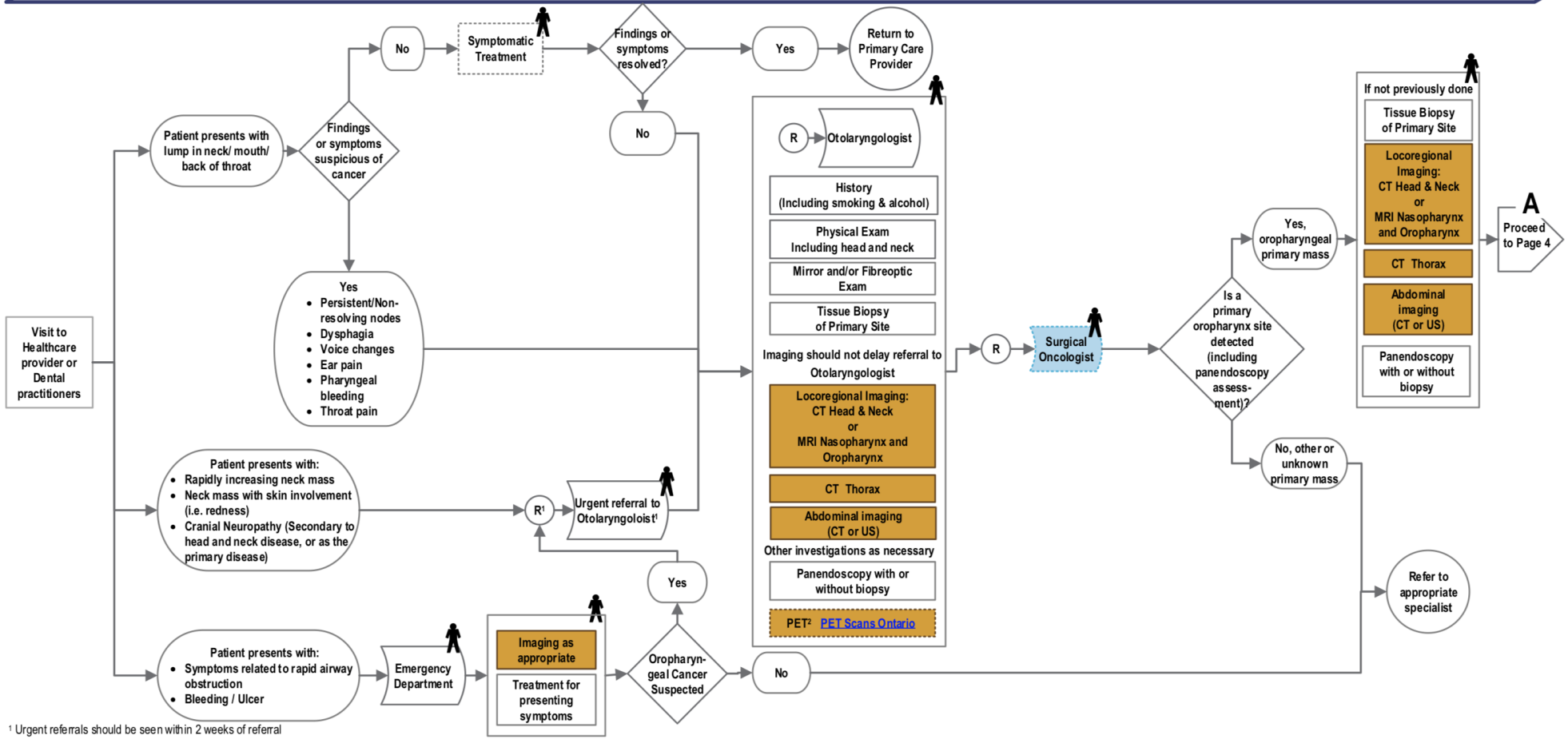
Disclaimer

The pathway map is intended to be used for informational purposes only. The pathway map is not intended to constitute or be a substitute for medical advice and should not be relied upon in any such regard. Further, all pathway maps are subject to clinical judgment and actual practice patterns may not follow the proposed steps set out in the pathway map. In the situation where the reader is not a healthcare provider, the reader should always consult a healthcare provider if he/she has any questions regarding the information set out in the pathway map. The information in the pathway map does not create a physician-patient relationship between Cancer Care Ontario (CCO) and the reader.

Oropharyngeal Squamous Cell Carcinoma Diagnosis Pathway Map

Screen for psychosocial needs, and assessment and management of symptoms. Click here for more information about symptom assessment and management tools

Consider the introduction of palliative care, early and across the cancer journey Click here for more information about palliative care



[1] Urgent referrals should be seen within 2 weeks of referral

[2] Unknown H&N Primary in histologically confirmed squamous cell carcinoma (neg. ENT exam, negative CT or MRI of the neck), note a panendoscopy is not required prior to PET scan. Baseline staging node positive (presumptive nodal stage N1-3) H&N Cancer where PET will impact radiation therapy.

Oropharyngeal Squamous Cell Carcinoma Diagnosis Pathway Map

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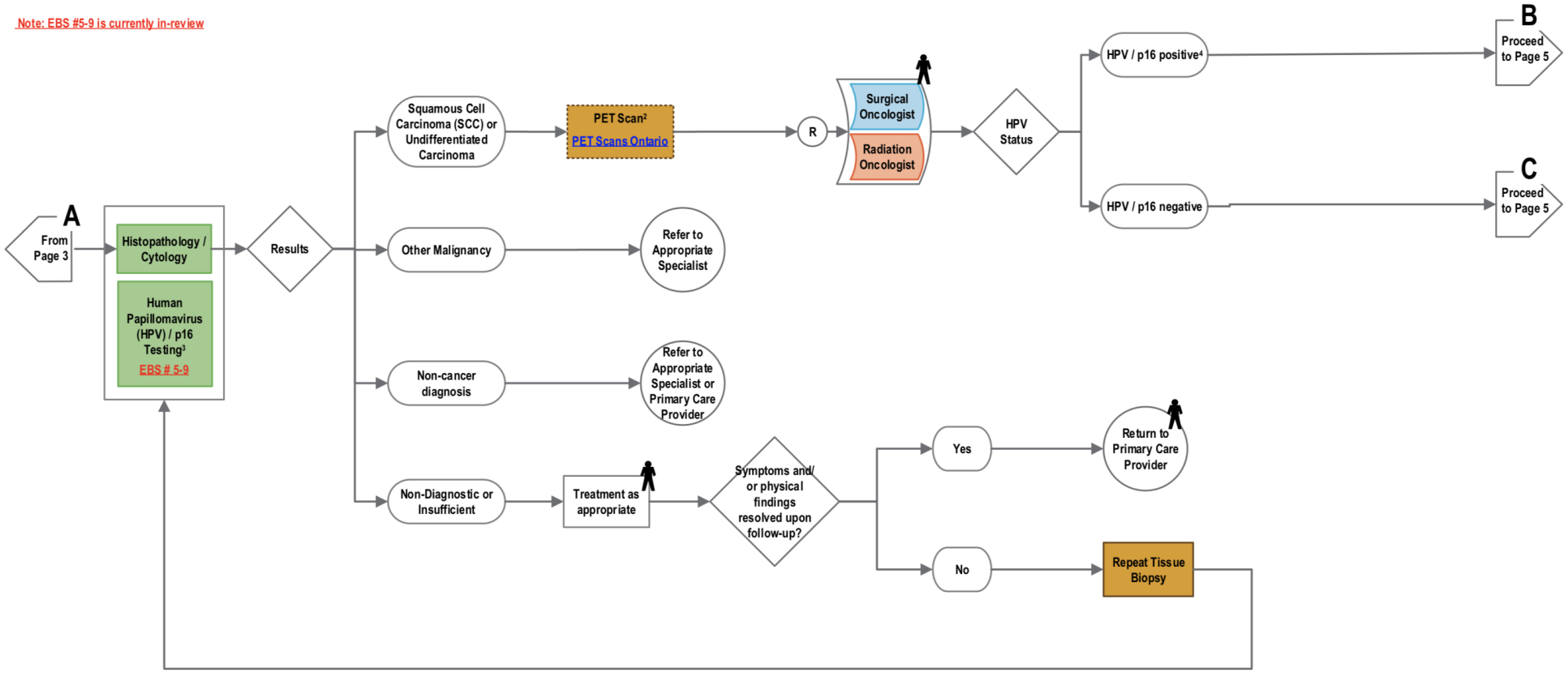
Note: EBS #5-9 is currently in-review



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[3] The tumours of all adult patients presenting with oropharyngeal squamous cell carcinomas should be routinely tested for HPV status.

[4] HPV positive status when the following criteria are met: cytoplasmic and nuclear staining, staining is moderate to strong and diffuse, staining is present in at least 50% of tumour cells (Refer to: EBS # 5-9). Some centres may require staining in at least 70% of tumor cells

Oropharyngeal Squamous Cell Carcinoma Diagnosis Pathway Map

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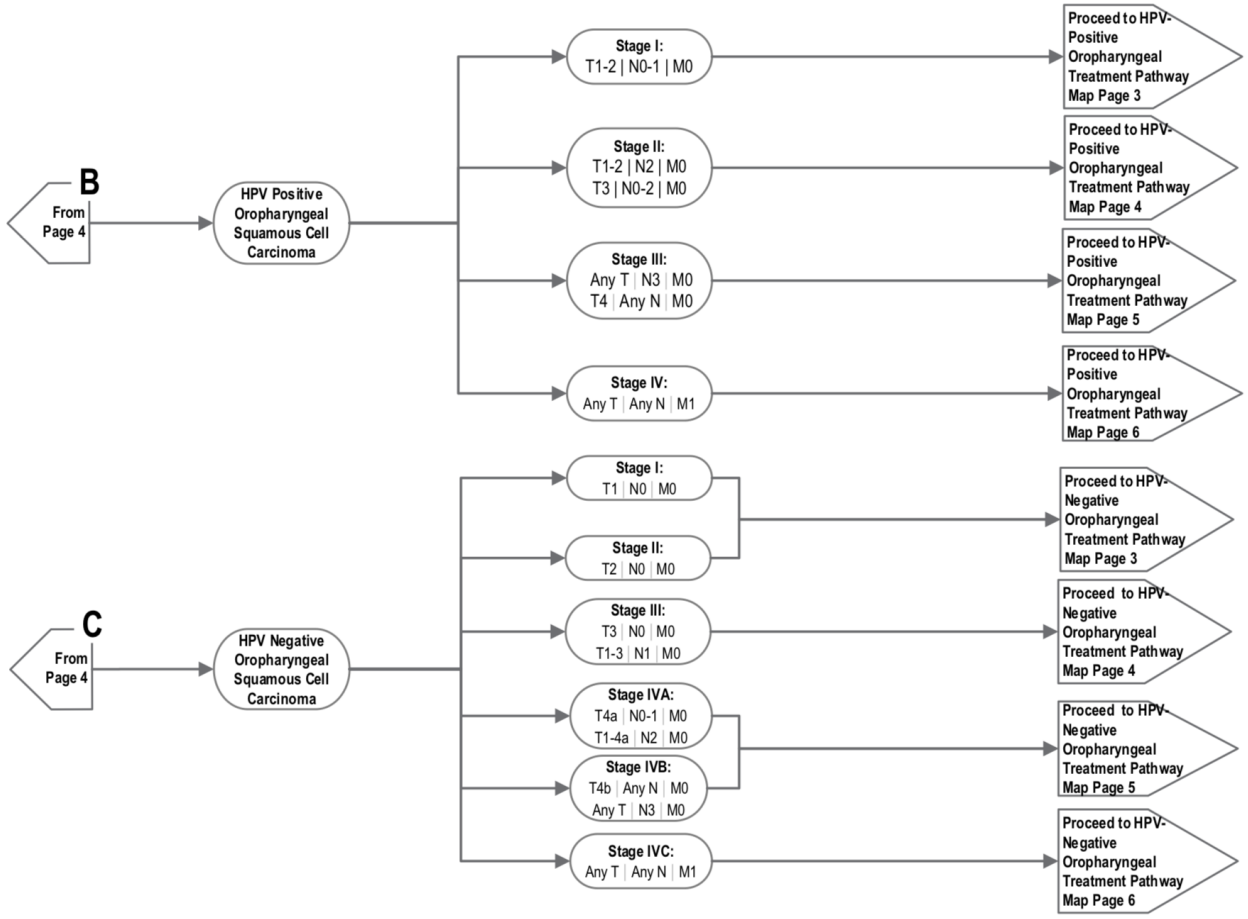

SUMMARY

- Reviewed classification and pathophysiology of primary brain tumours
- Reviewed fundamentals of MR Perfusion imaging using 3T
- Applied MR perfusion in the assessment of tumour progression versus radiation necrosis
- Future is Integration of MR in Cancer Imaging Protocols

THANK YOU