



Quality of Neuroimaging and Clinical Communication

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Quality in Neuroimaging and Communication

ASN 2026

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January 16, 2026

Learning Objectives

Review the core components of quality in neuroimaging

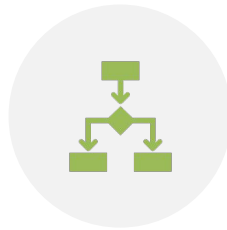
Understand how failures in these components impact patient care

Discuss importance of Imaging Reports

Why Quality in Neuroimaging Matters



- IMAGING DRIVES ACTION



- REPORTS ARE DECISION TRIGGERS



- TREATING CLINICIANS OFTEN NEVER SEE IMAGES



- KEY QUESTION: WHAT IS THE NEXT STEP?

Workload, Cost, and Systemic Burden

The Current Impact of Incidental Findings Found during Neuroimaging on Neurologists' Workloads

Thomas C. Booth , Jennifer M. Boyd-Ellison

Published: February 27, 2015 • <https://doi.org/10.1371/journal.pone.0118155>

Clinically irrelevant IFs	%
Cavum septi pellucidi	68*
Enlarged Virchow Robin spaces	51
Absent septum pellucidum	0.002
Ventricular asymmetry	6.1
Mega cisterna magna	0.25
White matter hyperintensities†	92‡

* young adults

†limited in number and not conforming to a disease pattern

‡percentage referring to 65–75 year olds.

doi:10.1371/journal.pone.0118155.t001

Increased Referral Volume

Lengthy Consultations

Management Dilemmas

Multidisciplinary Meetings

Concerns for Future Sustainability

When Quality Fails



- REPORTS ARE PATIENT-FACING



- WORDS OFTEN MATTER MORE THAN IMAGES



- AMBIGUITY LEADS TO HARM

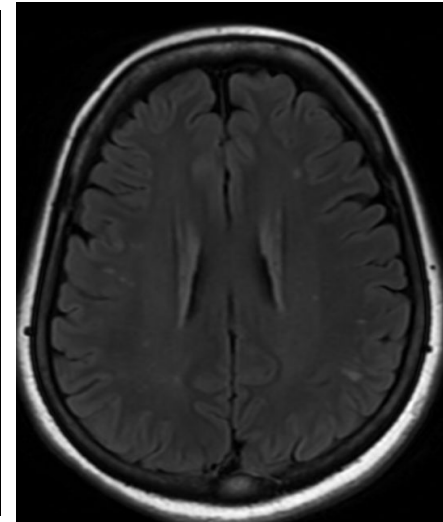
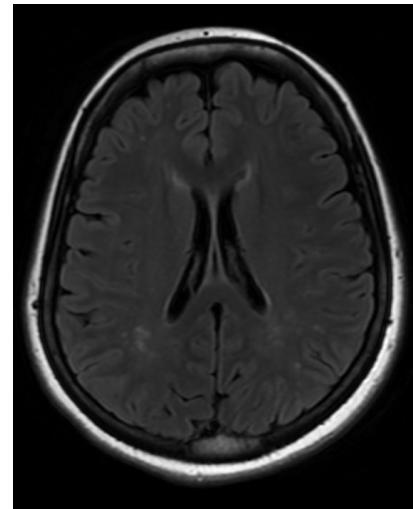
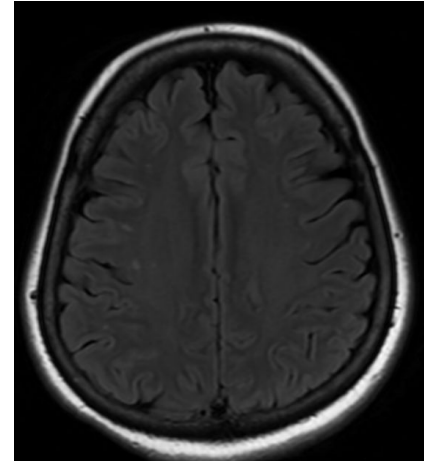
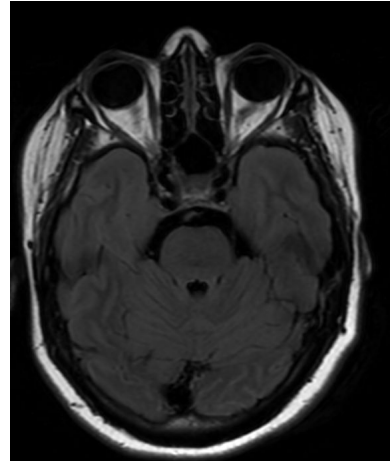


- REPORTS CARRY ACCOUNTABILITY

Case: 41 year old f with headaches and fatigue

Impression:

Numerous foci of T2/FLAIR prolongation in the supratentorial distribution are nonspecific. Differential considerations include chronic headache/migraine, sequelae of prior infection/inflammation or vasculitis, chronic small vessel ischemic changes. Demyelinating process remains in the differential and should be clinically correlated.



What Do We Mean by “Quality” in Neuroimaging?

- Quality = Diagnostic Value, not just image sharpness.
 - Right Study Selection — correct modality, protocol, and timing
 - Adequate & Reliable Acquisition — consistently diagnostic images
 - Clinically Relevant Interpretation — answers the clinical question
 - Actionable Communication — guides decisions clearly

The Four Pillars of Quality in Neuroimaging



- Right Test



- Right Protocol



- Right Timing



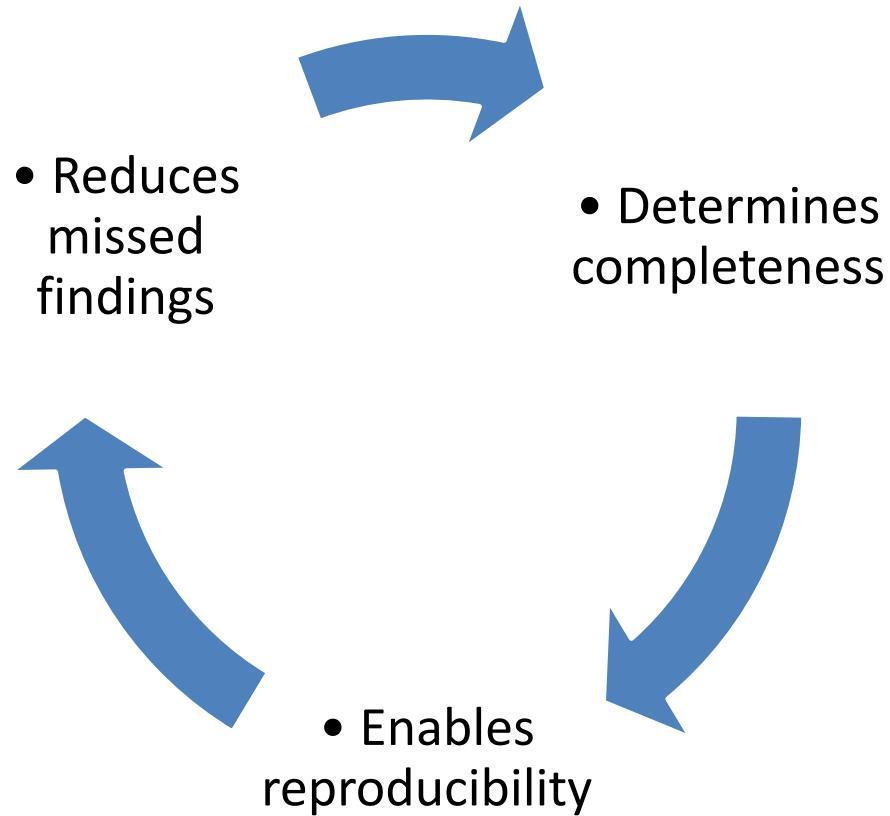
- Right
Communication

Right test

Aspect	Stroke	Cognitive Impairment
Goal	Rapid diagnosis for urgent treatment	Characterize disease subtype & exclude reversible causes
First-Line	CT for suspected acute ischemic stroke	Structural MRI to rule out structural causes
Advanced	MRI for ischemia & stroke mimics	PET/SPECT for subtype definition
Additional	CTA/MRA for large-vessel occlusion; Perfusion imaging for salvageable tissue	Combination of tests for comprehensive evaluation

JAMA 2021; NEJM 2020; Am Fam Physician 2020
Zerna et al. *Lancet*. 2018.
Mehan et al. *PLOS One*. 2014
Chouliaras et al., 2023

Right protocol



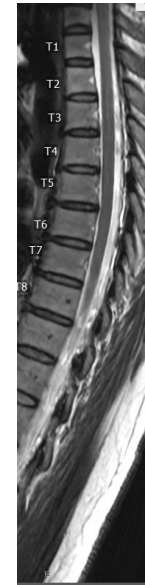
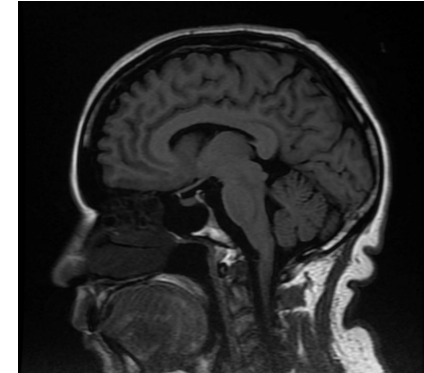
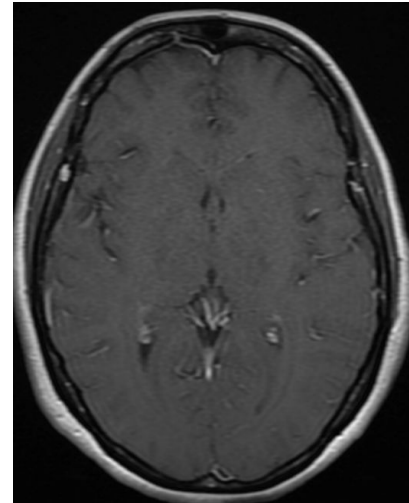
47 year old f with postural headache

-HISTORY: Spontaneous intracranial hypotension evaluation.

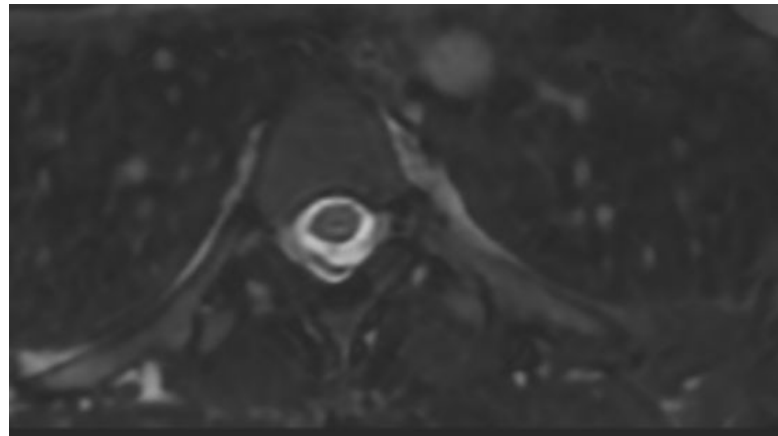
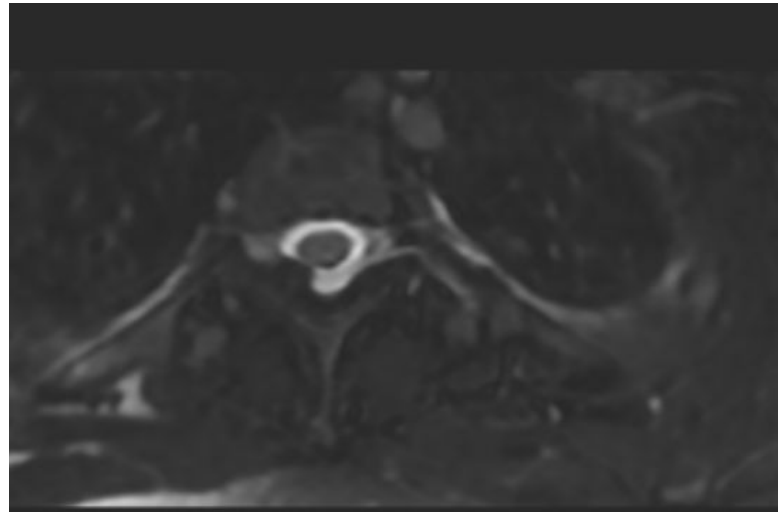
-TECHNIQUE: MRI of the cervical, thoracic, and lumbar spine performed on a 3.0 Tesla scanner without and with intravenous contrast.

-FINDINGS:

1. No convincing evidence of spinal longitudinal epidural collection or prominent meningeal diverticuli.
2. No cord signal abnormality. Normal appearance of the conus and cauda equina nerve roots. No abnormal enhancement.
3. No significant canal stenosis or neural foraminal narrowing.



Dorsal CSF Leak



Right Timing

- Sensitivity is time-dependent
- Wrong timing reduces value
- Know when not to scan

Mendelson et al., *JAMA* 2021
Honig et al., *AJNR* 2014
Ford et al., *Am Fam Physician* 2020
Zerna et al., *Lancet* 2018
Sarraj et al., *Ann Neurol* 2024

Right Communication

- Neuroimaging reports have substantial downstream impacts on clinical workload, healthcare resource utilization, patient anxiety, and clinical decision-making, though the magnitude varies by setting and specialty.

Imaging Reports

- Guides clinical decision-making
- Little formal training; learned indirectly
- Broad audience beyond ordering provider
- Findings: concise and factual
- Impression: synthesized, actionable guidance
- Skills must continually evolve

Communication-reporting structure

- Push toward structured reporting
- Benefits: consistency, clarity, fewer errors, data mining, financial upside
- Narrative benefits: flexibility, personalization, familiar for radiologists
- Referrers generally prefer structured formats
- Limited evidence of superior clinical outcomes
- Not all structured templates help interpretation
- Many are exam-based checklists (may feel generic or simplistic)
- Some radiologists resist due to lack of clinical tailoring

Report Example

FINDINGS:**BRAIN PARENCHYMA:****T2 hyperintense white matter lesions:**

***Periventricular:** [No|1-2|3 or more] lesions contacting the ependymal surface

***Juxtacortical/Cortical:** [None|Present]

***Infratentorial:** [None|Present involving the [brainstem|cerebellum|brainstem and cerebellum]]

***Optic Nerve:** [None|Present]

***Cervicomedullary Junction:** [None|Present]

Enhancing Lesions: [<# of enhancing lesions and locations>None]

Reduced Diffusion: [None|Present (describe)]

Overall Disease Burden: [None|<10 lesions|10-20 lesions|>20 lesions]

Parenchymal Atrophy: [None|Mild|Moderate|Severe]

Callosal Atrophy: [None|Mild|Moderate|Severe]

OTHER FINDINGS: [None]

IMPRESSION:

[Normal MRI brain.|Multiple white matter lesions that are [typical|atypical|not consistent] with demyelinating disease.]

2016 MAGNIMS MRI criteria to establish disease dissemination in space in multiple sclerosis (Lancet Neurol. 2016 Mar;15(3):292-303)

Involvement of at least two of five areas of the CNS as follows:

* Three or more periventricular lesions

* One or more infratentorial lesion

* One or more spinal cord lesion

* One or more optic nerve lesion

* One or more cortical or juxtacortical lesion

Case: 72 year old with altered mental status.

FINDINGS:

There is no hemorrhage, edema, mass effect, midline shift or hydrocephalus.

There is volume loss, chronic small vessel ischemia and atherosclerosis.

The basilar cisterns are maintained.



IMPRESSION: No acute intracranial abnormality is detected.

CLINICAL INVESTIGATIVE STUDY

Economic impact of selective use of contrast for routine follow-up MRI of patients with multiple sclerosis



Most routine MS follow-up exams do not require gadolinium



Unenhanced FLAIR reliably detects new or enlarging lesions



Contrast-conditional workflow reduced contrast use by ~60%

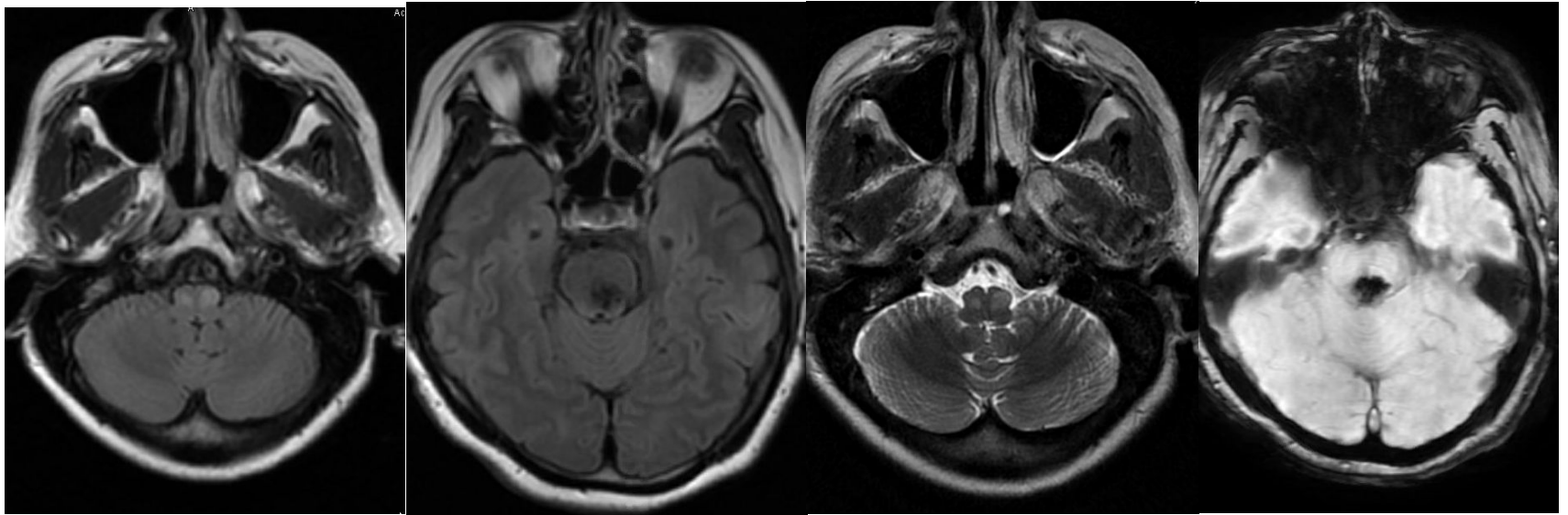


Saved ~20% of MRI scanner time with minimal revenue impact



Improves patient comfort, safety, and scanner availability


Case: 53 year old with recent L Pontine ICH with diplopia, torsional nystagmus



Impression: MRI of the head stable hemosiderin deposition within the brainstem related prior hemorrhage. However, there was new flair/T2 ovoid hyperintensities in the bilateral ventral medulla.

NeuroImaging Training as a Core Component of Residency Education

RESIDENT & FELLOW SECTION | January 21, 2019 | 

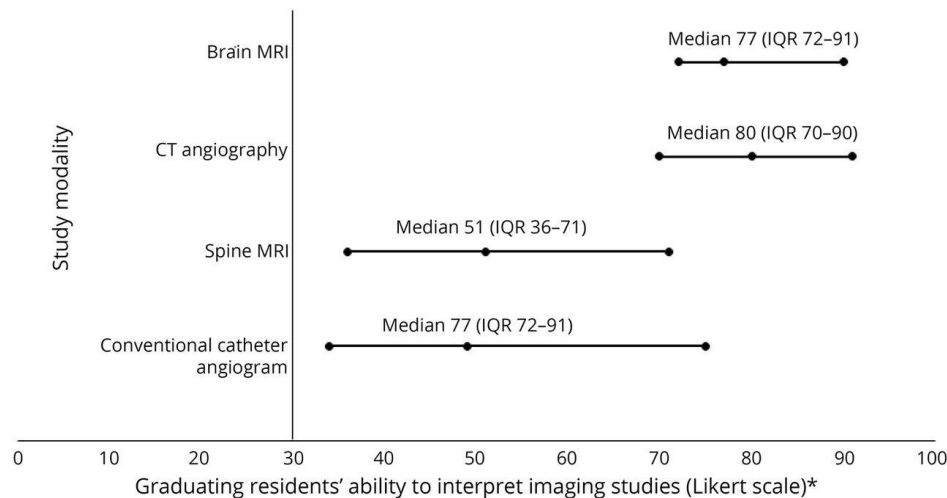
 Check for updates

Education Research: Neuroradiology curriculum in neurology residency training programs

How we teach neuroimaging

Paul D. Johnson, MD, Stefan Sillau, PhD, Joseph C. Masdeu, MD, PhD, Douglas E. Ney, MD, and Pearce J. Korb, MD | [AUTHORS INFO & AFFILIATIONS](#)

January 22, 2019 issue • 92 (4) 199-203 • <https://doi.org/10.1212/WNL.00000000000006812>



AI and Quality

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

AI IN MEDICINE

Jeffrey M. Drazen, M.D., *Editor*, Isaac S. Kohane, M.D., Ph.D., *Guest Editor*,
and Tze-Yun Leong, Ph.D., *Guest Editor*

The Current and Future State of AI Interpretation of Medical Images

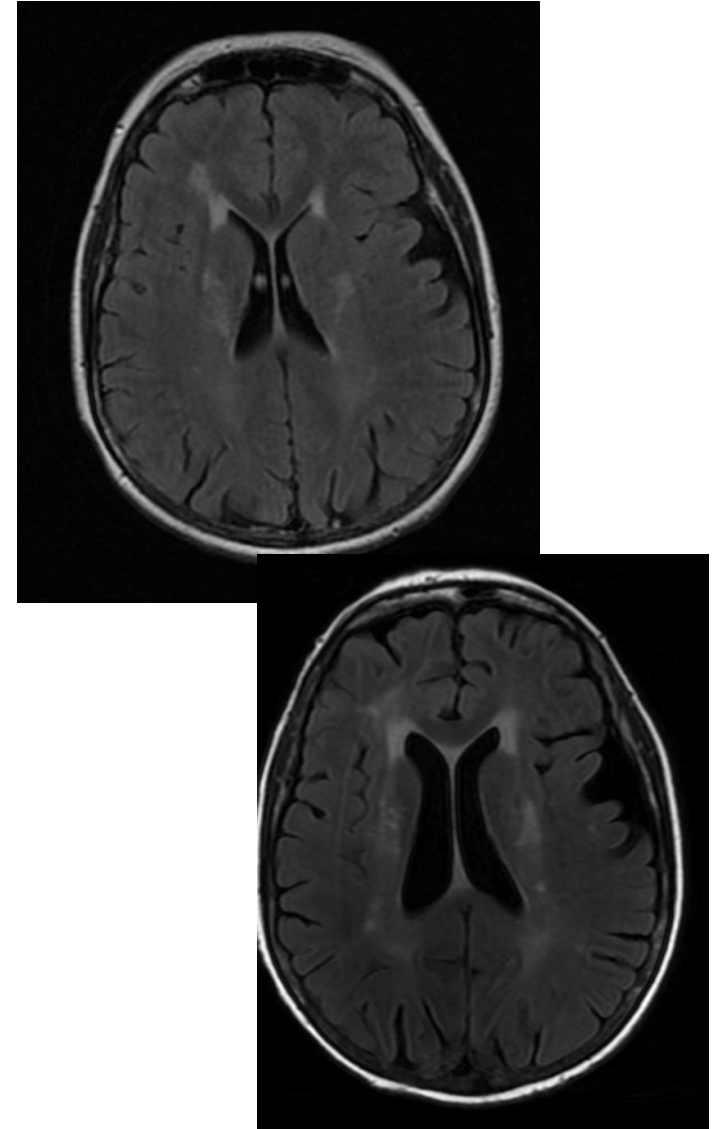
Pranav Rajpurkar, Ph.D., and Matthew P. Lungren, M.D., M.P.H.

- Improves speed and consistency
- Reduces variability
- Supports — not replaces — judgment

Case: 72 year old female with AMS

Impression:

The brain parenchyma shows stable moderate- to-advanced leukomalacia throughout the white matter of both cerebral hemispheres. The findings could be related to chronic demyelinating disease vs. advanced small vessel ischemic change. The white matter disease has progressed and become more confluent since October 12, 2012.



Key Take aways

- Imaging quality varies and drives diagnostic uncertainty + waste
- Right test/protocol/timing matter as much as scanner tech
- Reporting/communication often fail and burden clinicians
- Structured reporting helps consistency but needs context
- Quality is a pipeline — one weak step breaks value