Assessment Driven Approach to *Integrating Volumetric Software* for **MRI** in **Dementia**

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Objectives

- To establish a dialogue regarding the interpretation of dementia imaging in our current practice

- To review the current literature on dementia imaging and volumetric software

- To assess the data presented from two separate leading vendors in Volumetric MR assessment

- To establish internal standards for how to incorporate the volumetric data into our MR interpretation to help guide clinical decision making

Introduction

- As the population ages, the overall burden of dementia is increasing worldwide. The most common form of dementia in older adults is Alzheimer's disease (AD), accounting for 60-80% of cases.

- New disease-modifying therapies are available; these require pathological confirmation of abnormal amyloid pathology, usually via PET, which may not be available and/or reimbursed by insurance.

- MRI is routinely ordered for patients with dementia to "rule out" alternate pathologies but can also be used in more of a "rule in" capacity to suggest AD or other types of dementia based on patterns of atrophy.

- Reduced hippocampal volume or medial temporal lobe atrophy is the most characteristic focal finding in AD, in particular, when disproportionate to normal aging.

- Hippocampal volumetry using age-corrected norms can predict rates of progression of mild cognitive impairment (MCI) to dementia.

- Tools to generate these measurements are not in wide use, nor have these findings been validated in a clinical practice setting.

Methods

Volumetric software used
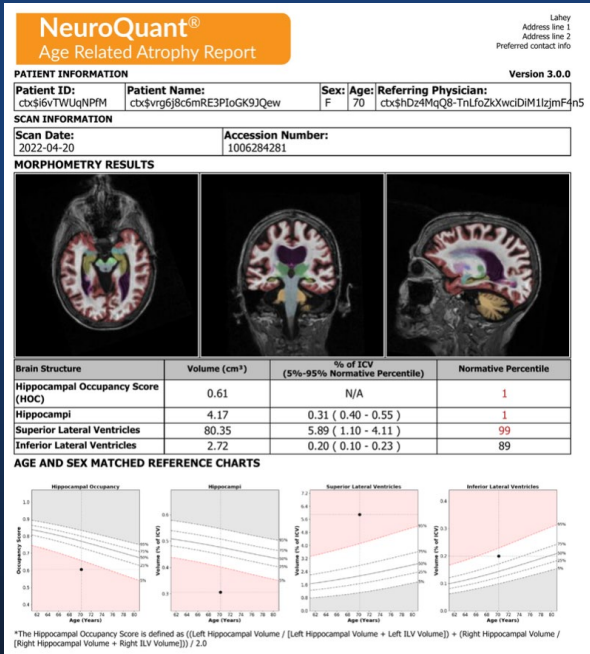
Cortechs.ai
NeuroQuant Dementia
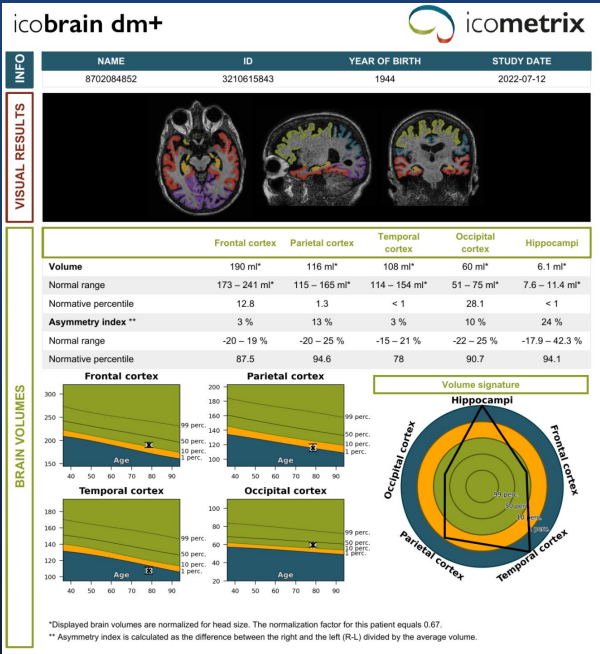
Icometrix
Icobrain dm

- We incorporated the manufacturer-specified imaging sequences into our MRI Dementia protocol

- MRI was interpreted by 1 of 6 fellowship trained / CAQ certified Neuroradiologists without access to any post-processed volumetric data

- Several months later, the radiologists were given the volumetric data, re-reviewed the MRI exam in retrospect, and filled out a questionnaire to assess the impact of this additional data

- 4 participating Neurologists were also asked to review the MRI images and volumetric data and answer questions assessing the impact of the data on their clinical diagnosis and management

Results

	Neuroquant	Radiologists	Icometrix	Radiologists	Neuroquant	Neurologists	Icometrix	Neurologists
Number of responses	59	54	41	32
Does this change your interpretation of the conventional MR images?	Yes, 11/59, 19%, Atrophy, especially hippocampal atrophy	Yes, 9/54, 20%, Atrophy, especially hippocampal atrophy	Yes, 12/41, 29%, Atrophy, especially hippocampal atrophy	Yes, 7/32, 22%, Atrophy, especially hippocampal atrophy
Does this change your diagnosis of the neurodegenerative disorder?	Yes, 4/59, 7%, AD considered more or less likely	Yes, 6/54, 11%, AD considered more or less likely	Yes, 11/41, 27%, AD considered more or less likely	Yes, 11/32, 34%, AD considered more or less likely
Does it help to rule out a diagnosis?	Yes, 5/59, 8%, AD felt to be less likely	Yes, 1/54, 0.02%, AD felt to be less likely	Yes, 15/41, 37%, AD felt to be less likely	Yes, 12/32, 38%, AD felt to be less likely
Does Neuroquantification data change your confidence in the imaging exam?	2/59, 3%, less confidence, 46/59, 78%, no change, 11/59, 19%, more confidence	4/54, 7%, less confidence, 30/54, 56%, no change, 20/54, 37%, more confidence	1/41, 2%, less confidence, 16/41, 39%, no change, 24/41, 59%, more confidence	1/32, 3%, less confidence, 9/32, 28%, no change, 22/32, 69%, more confidence
How would you rate the influence of this additional information on your interpretation of the conventional sequences?	28/59, 47%, no influence, 2/59, 3%, strong influence	26/54, 48%, no influence, 4/54, 7%, strong influence	4/41, 10%, no influence, 9/41, 22%, strong influence	0/32, 0%, no influence, 5/32, 16%, strong influence
How would you rate the influence of this additional information on your clinical interpretation?			4/41, 10%, no influence, 7/41, 17%, strong influence	1/32, 3%, no influence, 3/32, 9%, strong influence
Will this information change clinical management?			Yes, 11/41, 27%	Yes, 11/32, 34%

Ratings of influence of the QR on interpretation conventional sequences:

Neuroradiologists

Cortechs.ai — 47%, 31%, 14%, 5%, 3%

Icometrix — 48%, 9%, 19%, 17%, 7%
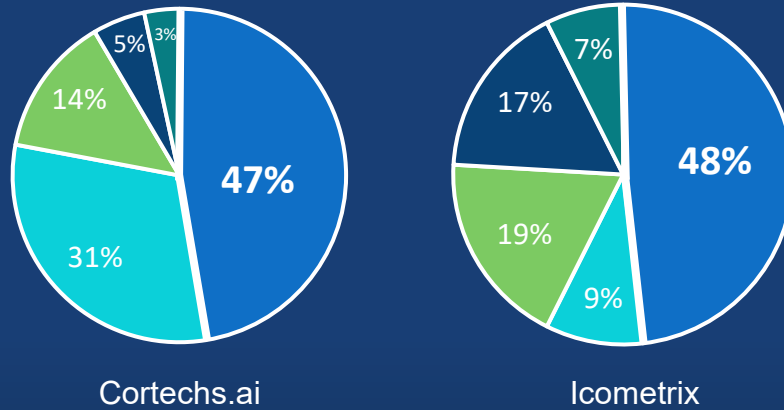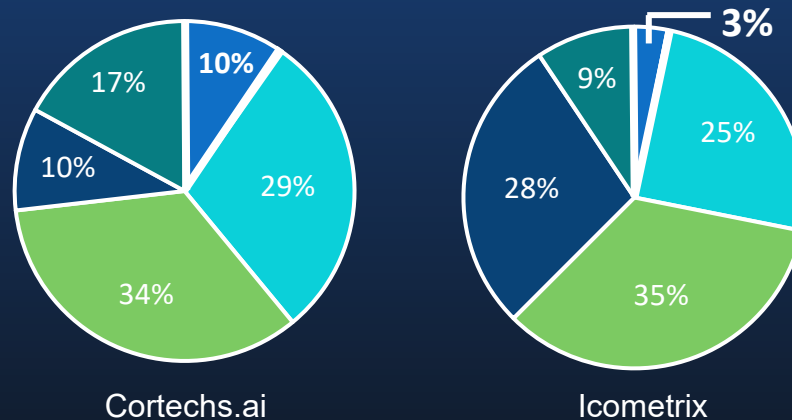
- **Neuroradiologists** felt more comfortable with the conventional images and were less influenced by the data presentation, given known limitations of volumetric data analysis, as well as lack of proven clinical and technical validation

Ratings of influence of the QR on clinical interpretation:

Neurologists

Cortechs.ai — 10%, 29%, 34%, 10%, 17%

Icometrix — 3%, 25%, 35%, 28%, 9%
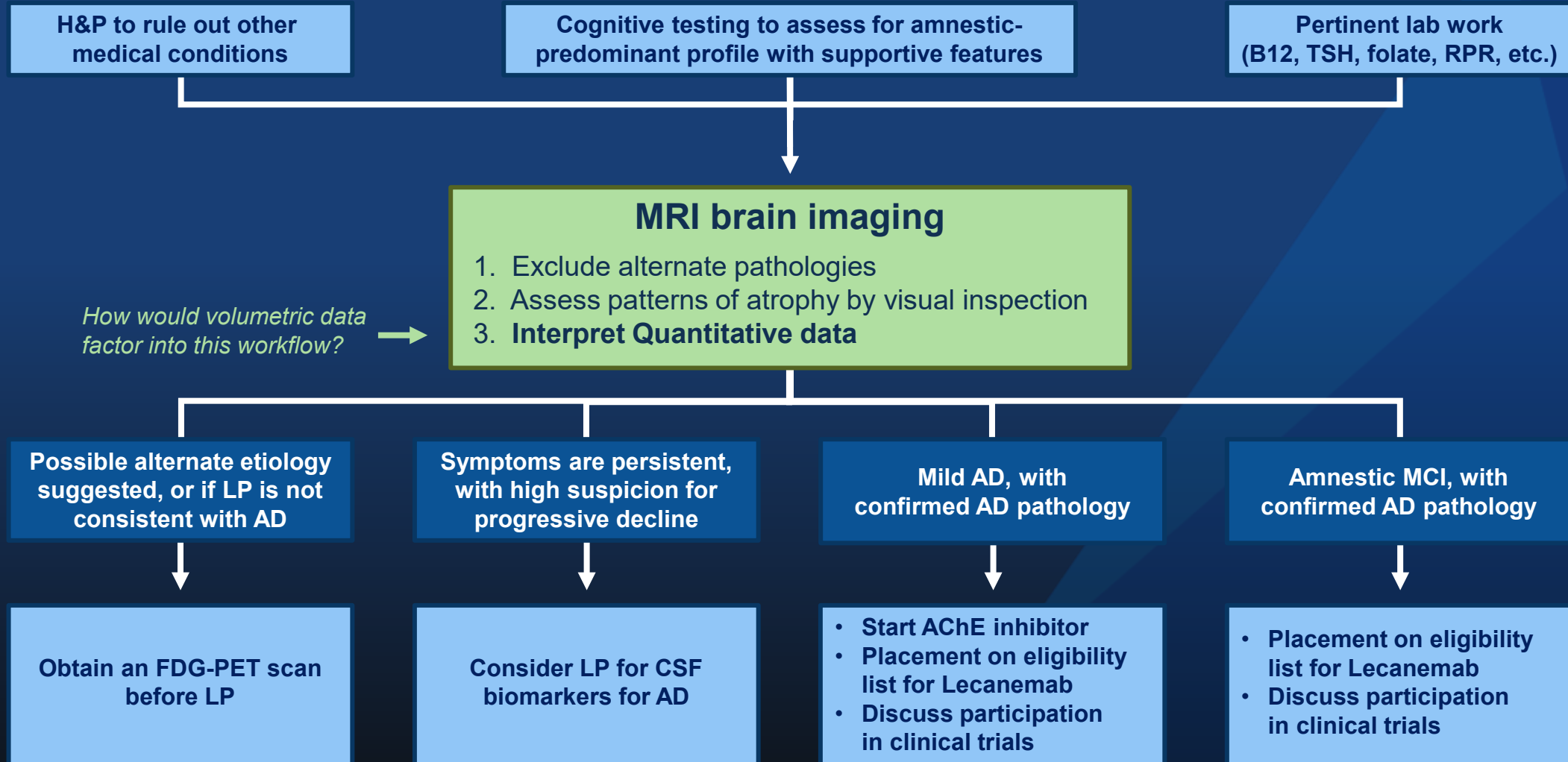
- **Neurologists**, however, indicated a stronger influence of the additional data on their interpretation of the imaging exam and on clinical management

Legend: ■ 1 ■ 2 ■ 3 ■ 4 ■ 5

No influence ⟶ *Strong influence*

Current Algorithm for Workup of MCI/AD

H&P to rule out other medical conditions

Cognitive testing to assess for amnestic-predominant profile with supportive features

Pertinent lab work (B12, TSH, folate, RPR, etc.)

MRI brain imaging
1. Exclude alternate pathologies
2. Assess patterns of atrophy by visual inspection
3. **Interpret Quantitative data**

How would volumetric data factor into this workflow? →

Possible alternate etiology suggested, or if LP is not consistent with AD

Symptoms are persistent, with high suspicion for progressive decline

Mild AD, with confirmed AD pathology

Amnestic MCI, with confirmed AD pathology

Obtain an FDG-PET scan before LP

Consider LP for CSF biomarkers for AD

- **Start AChE inhibitor**
- **Placement on eligibility list for Lecanemab**
- **Discuss participation in clinical trials**

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Discussion

- **What weight is given to the volumetric data?**

  The volumetric data is one of several possible indicators of AD, and should not be considered in isolation.

- **What will we consider abnormal hippocampal atrophy? 1 SD or 2 SD?**

  Disproportionate hippocampal atrophy 2 standard deviations below the norm would support the diagnosis of AD. Other areas of disproportionate atrophy could indicate an alternate dementia diagnoses.

- **How will radiologists factor the volumetric data into our MRI interpretation?**

  The conventional sequences will be reviewed and interpreted independently. The volumetric dataset will be assessed for diagnostic accuracy, noting specific patterns of atrophy, which can be confirmed by retrospective evaluation of the conventional sequences.

EXAM DESCRIPTION: MRI Brain without enhancement

TECHNIQUE: MRI Brain w/o enhancement was performed per [<Protocol>]

COMPARISON: [ ]

INDICATION: [ ]

FINDINGS:

BRAIN/EXTRAAXIAL:
[There is no restricted diffusion to indicate the presence of acute infarction.]
[There is no extra-axial collection, mass effect, or midline shift.]
[No large intracranial hemorrhage is identified.]
[The ventricles, sulci, and cisterns appear proportional and age-appropriate.]
[The major vascular flow voids are preserved.]

BONES/SOFT TISSUES: [ ]

VOLUMETRIC ANALYSIS: [Diagnostic.]

IMPRESSION: [ ]

Conclusion

- We described our approach to end user feedback-based acceptance testing and introduction of volumetric Ai software products into our practice.

- Assessment data was used to gain familiarity with the image appearance and results produced by the products as well as their resonance with the clinical providers.

- In the process we engaged in interdisciplinary dialogue, established interpretation standards, and outlined a clinical workflow, thereby allowing for a more comprehensive purchasing and implementation decision.

- The choice of the preferred solution for permanent production implementation was based on Radiologist preference for spatial resolution in the manufacturer specific source data sequence and Neurologists favoring a more comprehensive data presentation by one vendor.

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