Improved detection of clinically relevant MRI findings in Multiple Sclerosis radiology reports using FDA-approved quantitative software

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DISCLOSURES

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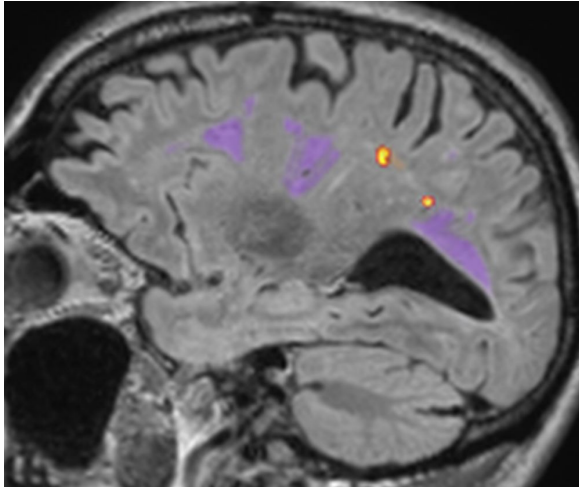
Contribution to this study was as a paid consultant, and was not part of his Stanford University duties or responsibilities

Lesion metrics relate to disease progression in multiple sclerosis (MS)



- Quantitative metrics (e.g. lesion count and brain volume) provide objective data of disease progression.
- Semi-automated software can improve lesion detection, which can impact treatment-related decision-making.[1]
- Implementation of FDA-cleared quantitative software in clinical practice requires significant effort and investment.
- Not yet established **if quantitative software can consistently improve detection of clinically relevant MRI findings** in MS-specific radiology reports.

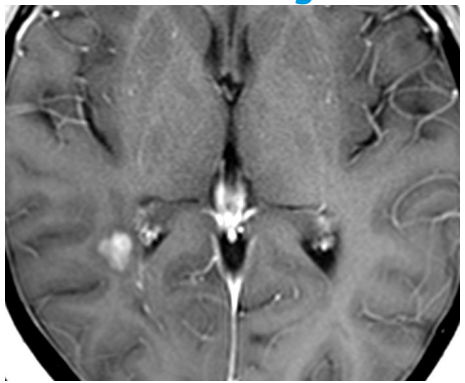
[1] Van Heerden J et al. *AJNR*, 2015

Can using FDA-cleared quantitative software improve lesion detection?

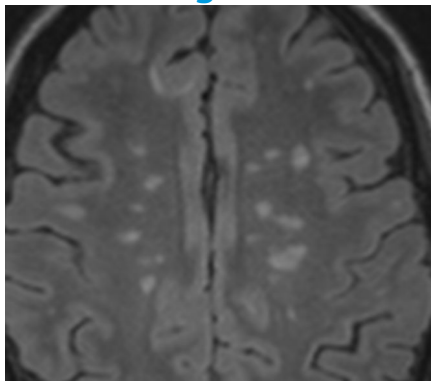
- To characterize clinically relevant findings in MS-specific radiology reports generated by a neuroradiologist after visual interpretation of images alone and with the use of FDA-cleared software.

Clinically relevant findings

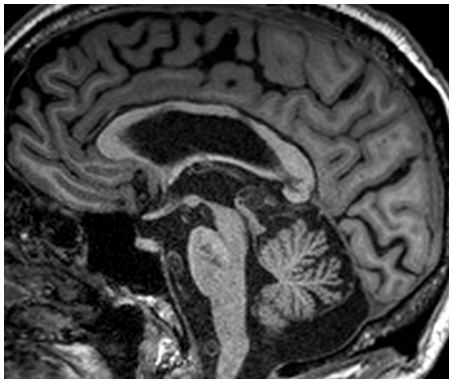
Gad+ Enhancing Lesion



New, Enlarging, and Shrinking T2 lesion

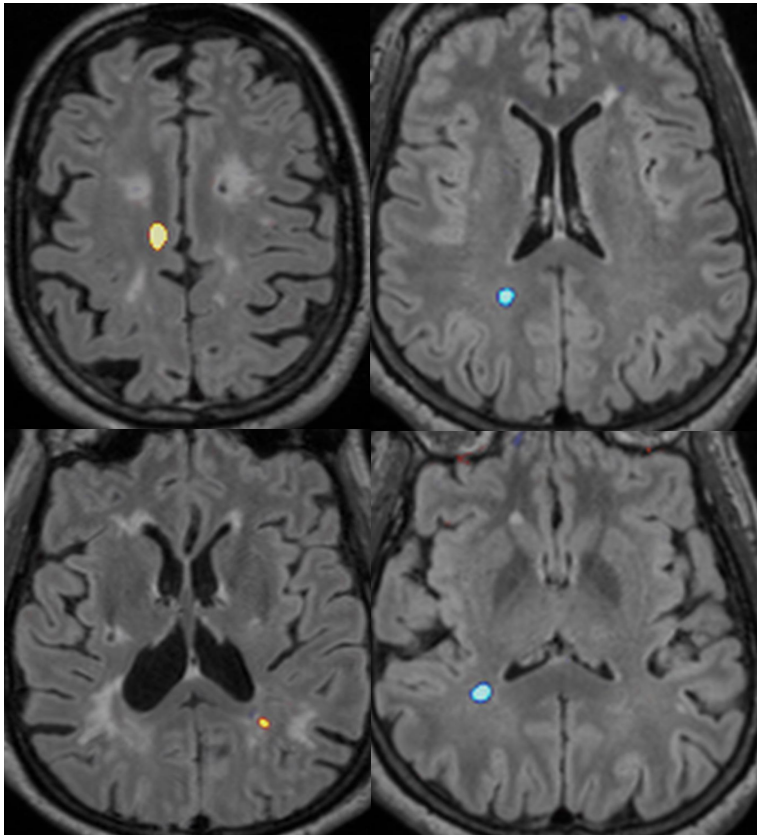


Brain Volume (atrophy)



Generate quantified MRI metrics and images

- Identify patients from anonymized retrospective MRI dataset between 2013-2017
- 2 MRIs/patient: 3D T1, 3D T2 FLAIR, T1-post
- 3D T1 and 3D T2 FLAIR images processed using FDA-cleared software (NeuroQuant & LesionQuant 3.0.1) to generate:
  - lesion count and volume
  - brain volume
  - **color-coded map that highlighted lesion changes between MRI timepoints**
    - **“Hot (red)”: new or enlarging lesion**
    - **“Cold (blue)”: shrinking lesion**



METHOD

Compare qualitative vs quantitative radiology reports

- Board-certified neuroradiologist visually compared MRIs and reported the number of new, enlarging, and shrinking T2 lesions, gad-enhancing lesions, and brain atrophy assessment in a **qualitative report (qual)**.
- To avoid recall bias, studies were randomized and re-anonymized, and one month later, the neuroradiologist used the post-processed data and images to generate a second **quantitative report (quant)**.
- Recorded time of interpretation and report generation during both sessions.
- Two neuroimaging experts coded report differences in the following categories:
  - Presence or absence of MS finding
  - Change in count or location
  - Change in qualitative descriptor

Improved lesion detection on quantitative report

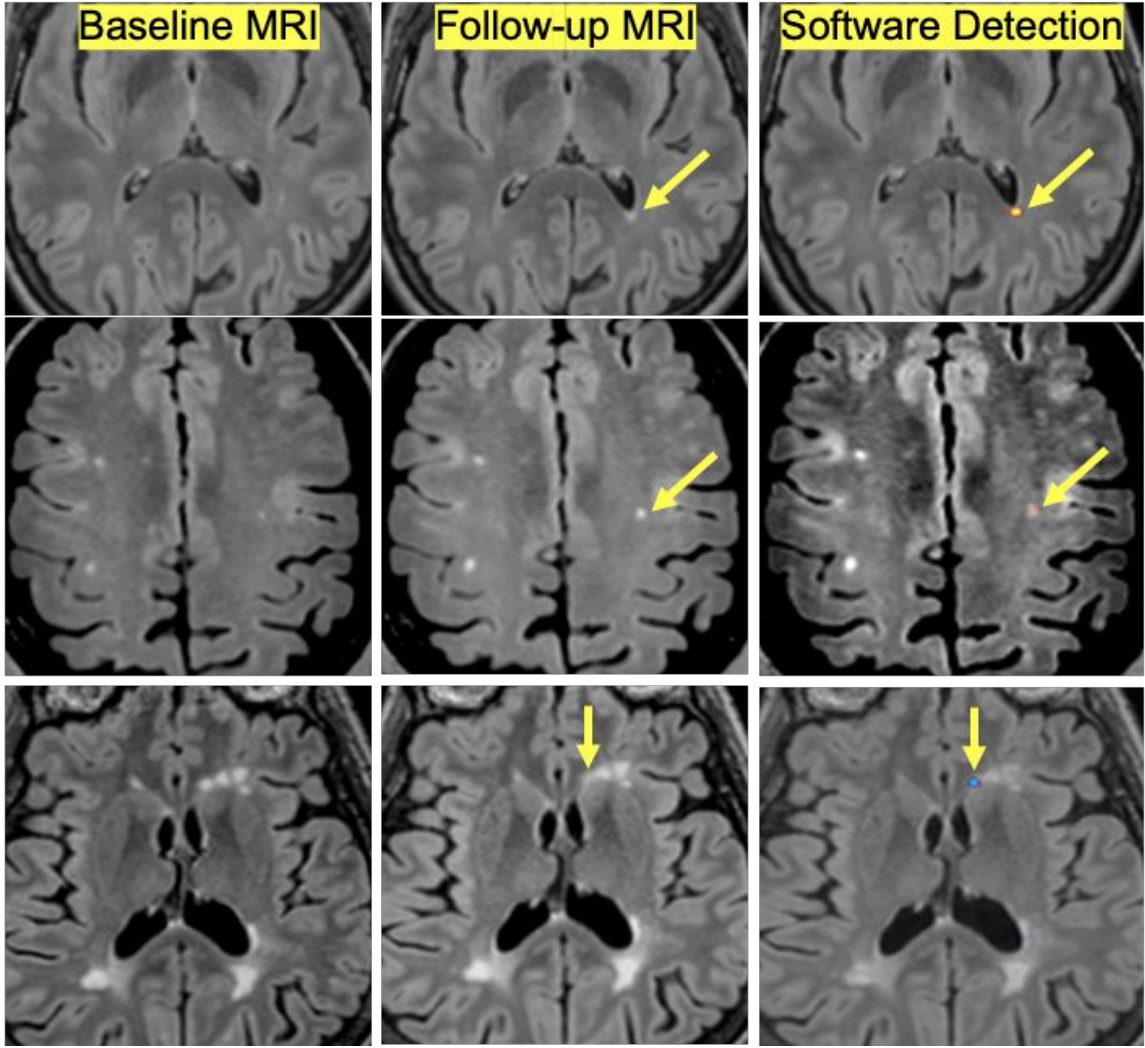
- 26 MS patients who had ≥2 brain MRIs (mean MRI time interval: 1 year)
- In **13 patients** we detected a difference between qual vs quant reports, where **quant reports had on average 1 more new, enlarging and/or shrinking lesion** (SD= 2.4).
- Brain atrophy descriptions changed with the addition of quantitative metrics in 7 cases, where 5 cases were upgraded and 2 cases were downgraded in severity.
- **No significant difference** (p=.16, paired t-test) was found **in interpretation time** (qual 12.3 minutes; quant 11.4 minutes).

Comparison of Lesion Counts

	Qual	Quant
New	44	**50**
Enlarging	10	**25**
Shrinking	5	**8**
Gad+ Enhancing	3	3

Examples:

Lesions missed on qualitative assessment



More clinical relevance in quantitative reports

- In addition to the metrics reported, **all quant reports provided information not available on qual reports**, such as T1 white matter hypointensity volume, and regional brain volumes over time
- Use of FDA-approved quantitative software i**mproved detection of clinically relevant neuroimaging findings in MS patients**, **without adding time to image interpretation**, suggesting its potential value in clinical practice

NEXT STEPS

Evaluate impact on clinical management

- Compare MS-specific radiology reports and lesion detection rates between general radiologists, neuroradiologists using visual assessment only, and neuroradiologists using combined visual assessment and FDA-cleared software
- Assess MS Neurologists' satisfaction of reports and evaluate potential changes to treatment plan and disease management

Questions?

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