Do we still need contrast agent to maximize sensitivity for new lesions in Multiple Sclerosis?


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1. Do we still need contrast agent to maximize sensitivity for new lesions in Multiple Sclerosis?

Purpose

Contrast agent is considered to be mandatory in MRI follow ups of patients with Multiple Sclerosis (MS). However, as patients with MS receive a multitude of MR scans over lifetime, they are especially prone to developing vascular intra-cranial gadolinium depositions. Hence, a more differentiated use of contrast agent seems inevitable for future MR protocols in MS patients.

One of the main justifications for contrast agent in MS follow up scans is to maximize sensitivity for new lesions. This is based on a result from 1993.

We investigated, whether this still holds true when a modern imaging protocol together with computational post processing techniques are used.

Methods

Subjects:

507 follow up MRI scans from 359 patients with MS or Clinically isolated syndrome.

MR Protocol:

- 3D FLAIR
- 3D T1+Gadolinium
- 3D T2
- 3D Double Inversion recovery (DIR)

Field strengths:

3 Tesla (Philips Achieva)

Additional postprocessing:

- Co-registration of all images from a single patient
- Generation of a longitudinal subtraction map of the DIR sequences
- Optimized subtraction maps of T1 sequences with and without contrast agent

Data analysis:

The methods included:

1. Identification of new lesions in non-enhanced images
2. Identification of contrast enhancing lesions
3. Co-registration of all images from a single patient
4. Generation of a longitudinal subtraction map of the DIR sequences
5. Optimized subtraction maps of T1 sequences with and without contrast agent

Identification of contrast enhancing lesions.

In each readout, the identified lesions were marked. Those markings were finally compared and discrepant lesions were counted, i.e. those lesions which showed a contrast enhancement but were not detected as new lesions in readout 1.

Results

Identified new lesions:

1992 in 264/507 scans

Contrast enhancing lesions:

207 in 69/507 scans

Discrepant lesions:

4 in 3/507 scans

Discussion

In our study, only 0.2% of all new lesions were missed without the use of contrast agent. Moreover, the lesions which were additionally detected did not contribute to the assessment of overall lesion load in a single case. Also, there was not a single pre-existing and unchanged lesion that showed a contrast enhancement.

This allows for the following conclusions:

1. Contrast agent can be regarded as dispensable for the detection of new lesions.
2. In scans which do not show new lesions, contrast agent does not provide additional information on disease activity.

Based on our observations, the only remaining use of contrast agent is the additional information on lesion age. We therefore propose to limit the administration of contrast agent to situations, in which this temporal information has direct consequences for therapy.

This proposed strategy can help to substantially reduce the cumulative lifetime dose of contrast agent in MS patients and therefore the risk of intracranial gadolinium depositions.

Figure: Example of a lesion missed without contrast agent

A: Baseline FLAIR
B: Follow up FLAIR
C: Follow up T1 + Gd
D: DIR subtraction map

The lesion marked with an arrow was only detected in the contrast enhanced T1 sequence. Retrospective analysis of the FLAIR sequences revealed a corresponding small new lesion that was missed in the first readout, which only used non-enhanced images.

Note that the longitudinal DIR subtraction map and the follow up images both show a high burden of contrast enhancing lesions. Therefore, the marked small lesion did not change the overall assessment of lesion progression.

References: