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Epilepsia®

LETTER

Apples and oranges

1 | INTRODUCTION

We read with interest the article of Irene Wang and co-workers emphasizing the value of 7T magnetic resonance imaging (MRI) to detect (subtle) focal cortical dysplasia (FCP).[1] In a prospective cohort of 67 patients, previously classified as nonlesional epilepsy, they investigated the additional value of 7T MRI morphometric postprocessing (MAP07) using the magnetization prepared 2 rapid gradient echo (MP2RAGE) sequence compared to 3T MRI morphometric postprocessing based on the magnetization prepared rapid gradient echo (MPRAGE) sequence.

The study clearly shows that the detection and delineation of FCD using MAP postprocessing can be improved by advanced imaging methods. But does this show the superiority of 7T compared to 3T? We advise caution, as junction images generated from 3T MPRAGE sequences were compared with junction images generated from 7T MP2RAGE-sequences.[2] The MP2RAGE sequence is a refinement of the MPRAGE sequence. It combines two MPRAGE data sets acquired at different inversion times and creates a homogeneous T1-weighted contrast with an intrinsic correction of B1-inhomogeneities and reduced residual proton density and T2* weighting.[3] Compared to MPRAGE images, MP2RAGE "unified" images show a higher contrast ratio and a higher contrast-to-noise ratio, even with the same field strength.

Of note, more FCDs are being detected and FCDs have higher Z-scores and are displayed with larger volumes when MP2RAGE sequence is being used at the same field strength, which has been addressed recently in a study with MAP junction images in FCD patients at 3T[4] (Figure 1).

Irene Wang and co-workers argue that the detection is particularly improved because FCDs in the 7T group appear to have higher Z-scores than lesions in the 3T group. We would like to point out that Z-scores also represent a function of the

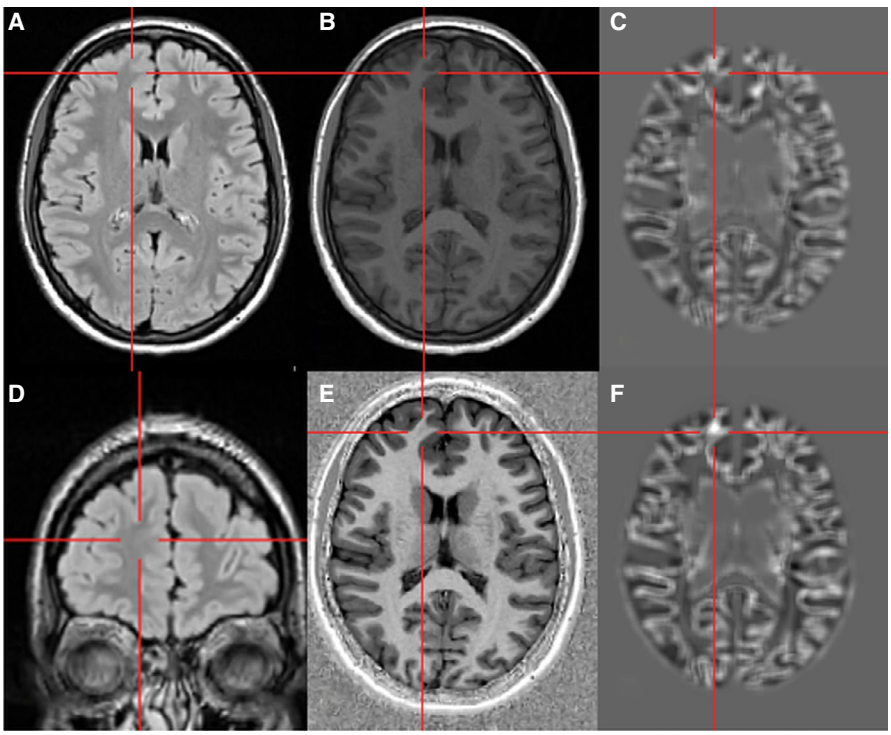

FIGURE 1 A and D are reformatted fluid-attenuated inversion recover (FLAIR) images generated from a 3T sagittal three-dimensional (3D) FLAIR sampling perfection with application optimized contrasts using different flip angle evolution sequence. A subtle focal cortical dysplasia (FCD) of the right superior frontal gyrus is marked with a crosshair. See the higher contrast on magnetization prepared 2 rapid gradient echo (MP2RAGE) (E) compared to magnetization prepared rapid gradient echo (MPRAGE) images (B) and the brighter and larger lesion on MP2RAGE junction (F) compared to MPRAGE junction images (C)

sequence being used; this is an important confounding factor. Furthermore, device-specific normal populations influence Z-scores[2] and make it difficult to interpret study results between centers. Therefore (also in the study by Wang and co-workers) empirical thresholds are usually applied to the Z-scores, which ultimately has an effect on the number of true and false-positive findings, both to be evaluated and presented separately in each study on morphometric analysis whenever possible.

CONFLICT OF INTEREST

HU received fees as speaker from Bayer AG, Bracco, Eisai, Stryker, and UCB Pharma, and is shareholder of the Veobrain GmbH. TD has no conflict of interest.

ETHICAL PUBLICATION STATEMENT

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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LETTER

In response: Apples and oranges

We appreciate the interest and comments from Demerath et al on our study.[1] We showed compelling evidence that in a substantial percentage of patients undergoing epilepsy presurgical evaluation whose 3T study was negative, that 7T can produce positive findings that were often relevant to the underlying epilepsy. The efficacy of 7T in this setting is directly supported by our data showing that unaided visual review of 7T (without using the voxel-based morphometric analysis program, or MAP) already detected previously unappreciated subtle lesions in 22% of cases, including 5 cases in which MAP was negative. As pointed out by the comment, when it comes to post-processing with MAP, it is indeed important to realize that the junction images generated on the 3T magnetization-prepared rapid acquisition with gradient echo (MPRAGE) sequence were compared with junction images generated on the 7T magnetization-prepared two rapid acquisition gradient echoe (MP2RAGE) sequence. We would like to point out that our study was designed to best utilize 7T for subtle lesion detection in a clinical setting, rather than to compare the two sequences at different field strengths. It was necessary to use MP2RAGE at 7T due to the field inhomogeneity at ultra-high field; therefore, by nature of the study design, the question of whether the yield was due to the field strength or different sequence was not the focus of the study. Perhaps, prompted by the interesting data recently published by Demerath et al on 3T,[2] switching from MPRAGE to MP2RAGE on 3T could be a viable way to improve the subtle focal cortical dysplasia (FCD) detection yield for centers that do not have a 7T.

The points raised on the z-score of MAP are also important and well appreciated. We agree that the z-scores are influenced by many factors, including the number of normal controls and the scanner/sequence used. Empirical thresholds are usually applied to the z-scores, which may differ for studies from different centers, and may prevent direct comparison across these studies. Before automated MAP lesion detection is feasible (and artificial-neural-network-powered studies are already on the horizon), a definite, optimal z-score threshold is likely not attainable. This z-score issue was already pointed out by our Limitations section and hopefully reiterated to the readers by this comment.

Version Nov 7, 20, 6:00 PM

KEYWORDS

7T, FCD, MAP, MP2RAGE, MRI, postprocessing

CONFLICT OF INTEREST

Irene Wang reports no disclosures. Stephen Jones received travel and speaker fees from SIEMENS Healthineers.

ETHICAL PUBLICATION STATEMENT

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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ANNOUNCEMENTS

Epilepsia – January 2021 – Announcements

ILAE CONGRESSES

XI Congreso Latinamericano de Epilepsia

27 February–1 March 2021
Modalidad Presencial a Distancia | Virtual congress
https://www.epilepsycongress.org/lace/

13th Asian and Oceanian Epilepsy Congress (AOEC)

10–13 June 2021
Fukuoka, Japan | Virtual congress
https://www.epilepsycongress.org/aoec/

34th International Epilepsy Congress

28 August–1 September 2021
Paris, France
https://www.epilepsycongress.org/iec/

11th Summer School for Neuropathology and Epilepsy Surgery (INES 2020)

9–12 September 2021
University Hospital, Erlangen, Germany
https://www.ilae.org/congresses/11th-international-summer-school-for-neuropathology-and-epilepsy-surgery-ines-2021

14th European Congress on Epileptology (ECE)

9–13 July 2022
Geneva Switzerland
http://www.epilepsycongress.org/ece/

ILAE WEBINARS

ILAE-EMR Webinars in French and English

Monthly webinars covering various subjects in epilepsy, ranging from basic to advanced, from neonatal epilepsy to issues in the elderly. See all future and past webinars - https://www.ilae.org/congresses/webinars

YES Webinars

The ILAE-Young Epilepsy Section Epilepsy Webinars provide educational content and hot topics in epilepsy care and research, presented by international experts. Join the live broadcast or browse the database of previous talks here.

OTHER CONGRESSES

Fetal and Neonatal Neurology Congress

3–5 March 2021
Paris, France
https://www.mcascientificevents.eu/brain/

65th Annual meeting: DGKN 2021. German Society for Clinical Neurophysiology and Functional Imaging

10–12 March 2021
Frankfurt, Germany
https://www.dgkn-kongress.de/index.php?id=618

1er Curso Latinoamericano Teórico práctico de Electrocencefalografía Clínica

8–10 April 2021
Santiago, Chile
https://www.ilae.org/congresses/1er-curso-latinoamericano-te-rico-pr-ctico-de-electrocencefalograf-a-cl-nica

11th EPODES - Epilepsy Surgery – Basic

12–16 April 2021
Czech Republic
http://www.ta-service.cz/epodes2021

Treatment Strategies in Pediatric Epilepsies 2nd cycle, 1st EPIPED course

21–24 April 2021
Girona, Spain
https://www.epiped-course.com/

Epilepsy 2020: A Vision of the Future in Epilepsy Research

7–8 May 2021
Montreal Neurological Institute-Hospital (The Neuro) in Canada
https://www.ilae.org/congresses/epilepsy-2020-a-vision-of-the-future-in-epilepsy-research

International Training Course on Neuroimaging of Epilepsy

13–16 May 2021
McConnell Brain Imaging Centre, Montreal, Canada
https://www.mcgill.ca/neuro/events/international-training-course-neuroimaging-epilepsy

5th Dianalund Summer School on EEG & Epilepsy

18–24 July 2021
Dianalund, Denmark
https://www.ilae.org/congresses/5th-dianalund-summer-school-on-eeg-and-epilepsy

2021 Advanced San Servolo Epilepsy Course Bridging Basic with Clinical Epileptology - 7: Accelerating Translation in Epilepsy Research

20–31 July 2021
San Servolo (Venice), Italy

Annual Meeting on Imaging in Epilepsy, Epilepsy Surgery, Epilepsy Research and Cognitive Neurosciences (AMIE 2021)

13–15 September 2021
Bochum, Germany
https://www.ilae.org/congresses/annual-meeting-on-imaging-in-epilepsy-epilepsy-surgery-epilepsy-research-and-cognitive-neurosciences-amie-2021

Summer School on Imaging in Epilepsy, Epilepsy Surgery, Epilepsy Research, and Cognitive Neurosciences (SuSIE 2021)

15–17 September 2021
Bochum, Germany
https://www.ilae.org/congresses/summer-school-on-imaging-in-epilepsy-epilepsy-surgery-epilepsy-research-and-cognitive-neurosciences-susie-2021

2020 ILAE British Branch Annual Scientific Meeting

28–30 September 2021
Cardiff, UK
https://www.ilaebritishconference.org.uk/

9th Eilat International Educational Course: Pharmacological Treatment of Epilepsy

10–15 October 2021
Jerusalem, Israel
https://www.eilatedu2021.com/

7th UAE Epilepsy Congress

22–23 October 2020
Dubai, UAE
http://congress2020.elae.ae/

2022

EPNS: 14th European Paediatric Neurology Society Congress: Precision in Child Neurology

28 April–2 May 2022
Glasgow, UK
'hybrid' event combining both a physical meeting in Glasgow with virtual attendance also possible https://epns-congress.com/

2023

15th European Paediatric Neurology Society Congress (EPNS) From genome and connectome to cure

20–24 June 2023
Prague, Czech Republic
https://www.epns.info/epns-congress-2023/