

# Universidad de Valladolid



# White Matter Alterations in Chronic Migraine: A Diffusion Tensor Imaging and Structural Connectivity Study

Álvaro Planchuelo-Gómez<sup>1</sup>, David García-Azorín<sup>2</sup>, Ángel L Guerrero<sup>2</sup>, Santiago Aja-Fernández<sup>1</sup>, Margarita Rodríguez<sup>3</sup>, Rodrigo de Luis-García<sup>1</sup>

Laboratorio de Procesado de Imagen (LPI), Universidad de Valladolid, Valladolid, Spain
 Headache Unit, Department of Neurology, Hospital Clínico Universitario de Valladolid, Valladolid, Spain

3. Department of Radiology, Hospital Clínico Universitario de Valladolid, Valladolid, Spain





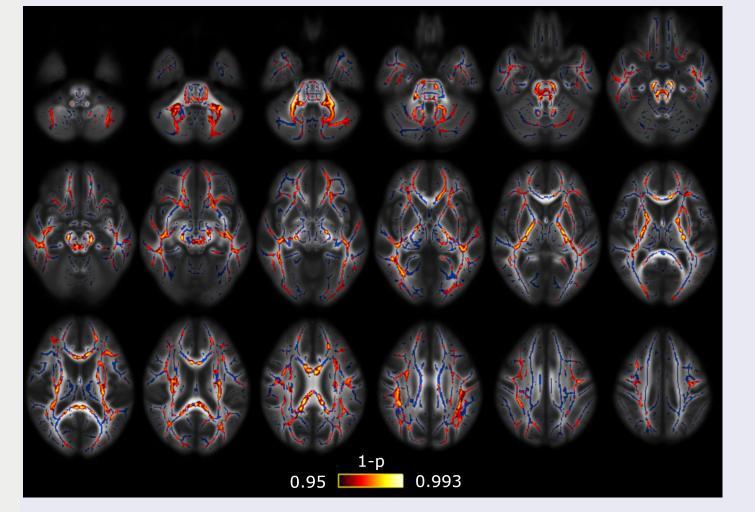
## **BACKGROUND & OBJECTIVES**

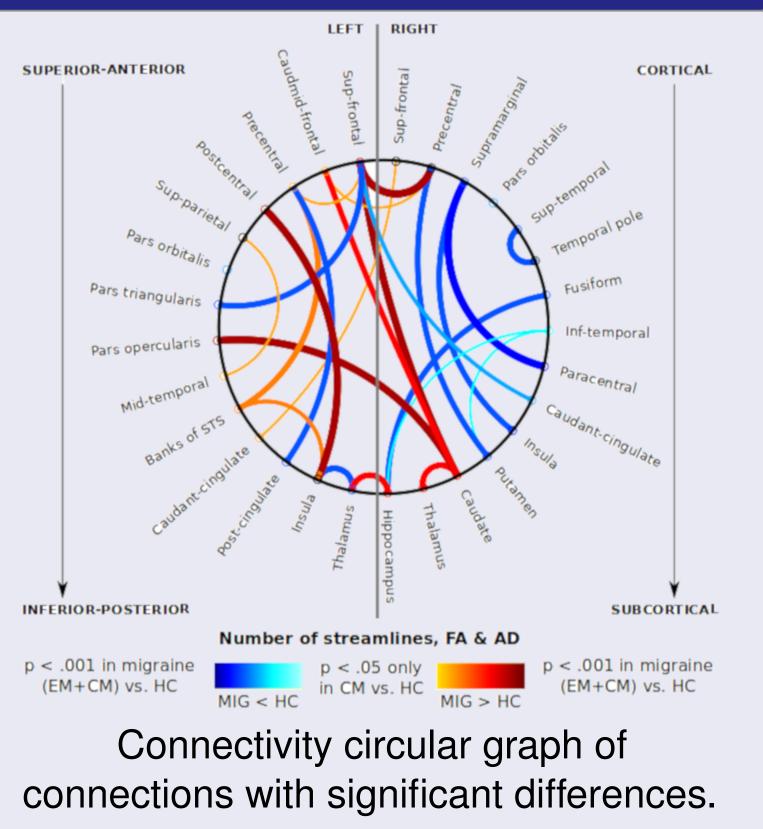
Diffusion Magnetic Resonance Imaging (MRI) studies have been widely used to identify white matter alterations in migraine patients with respect to healthy controls. However, no differences between Episodic Migraine (EM) and Chronic Migraine (CM) patients have been found using **diffusion MRI** (dMRI).

Structural connectivity in migraine has not been as widely studied as generalized white matter alterations. It has been reported that brain in migraine tends to be clustered. No specific structural connectivity analysis between EM and CM

## RESULTS

 $\label{eq:stable} \begin{array}{l} \text{TBSS} \rightarrow \text{Axial Diffusivity (AD)} \\ \text{CM} < \text{EM in 38 white matter tracts} \end{array}$ 





patients was found.

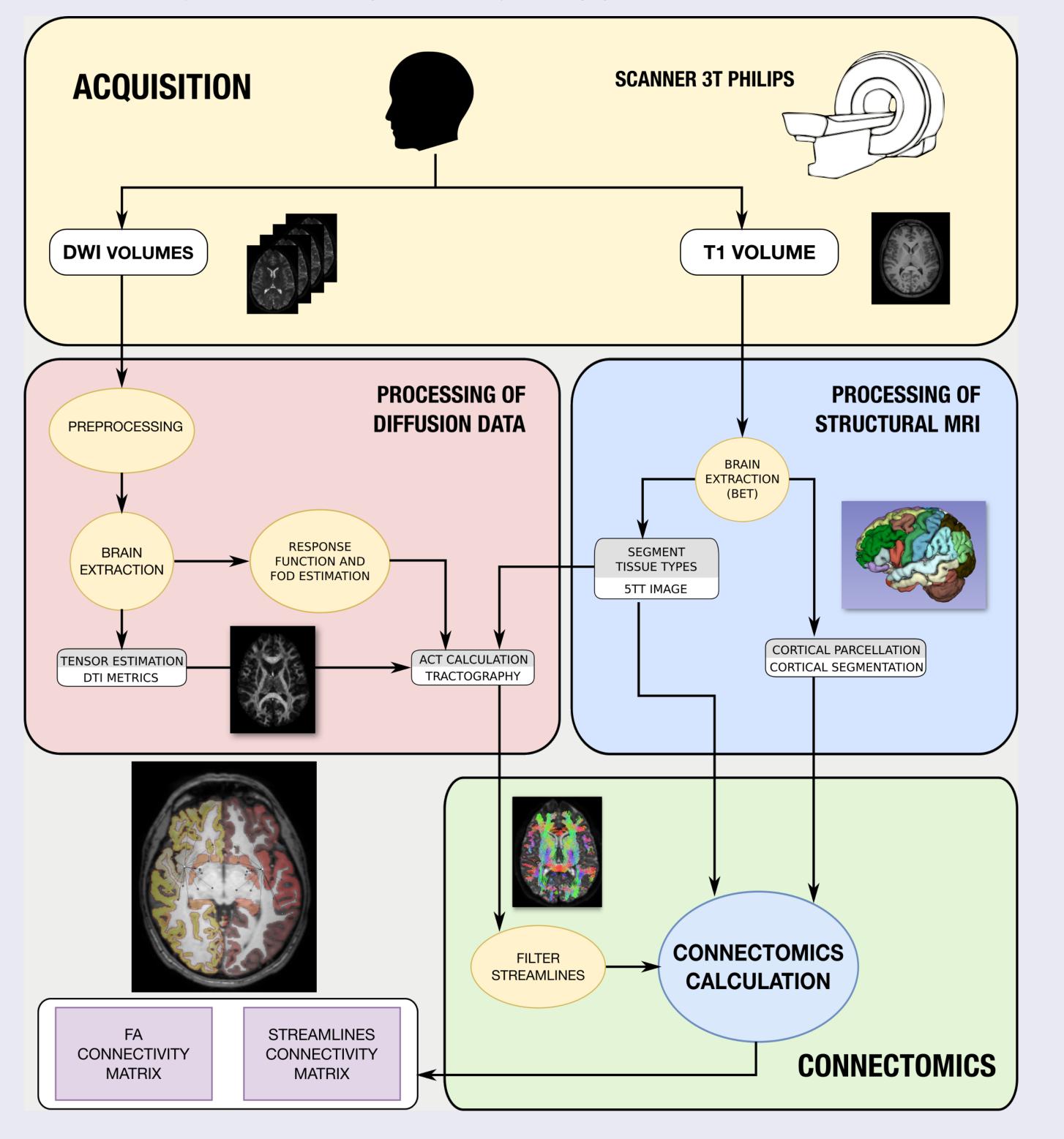
With a final sample of **50 Healthy Controls, 54 EM and 56 CM patients**, our objectives were:

1. Investigate whether there are significant differences between CM and EM, and between these groups and healthy controls. To that end, Tract-Based Spatial-Statistics (**TBSS**) was employed as dMRI analysis technique

2. Investigate whether there are significant **structural connectivity** differences between CM and EM, and between these groups and healthy controls. To that end, **whole-brain structural connectomics** was employed as a dMRI analysis technique.

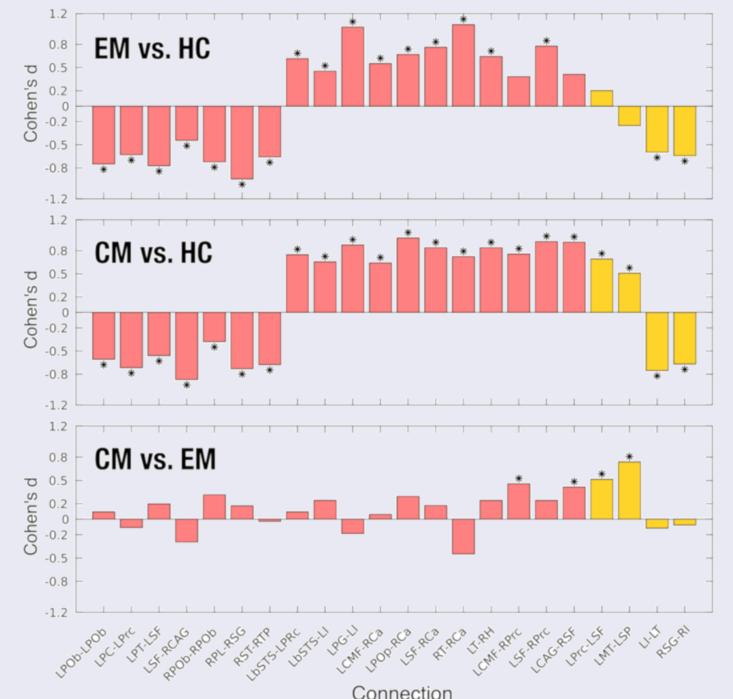
### METHODS

A summary of the whole processing MRI pipeline is shown here:



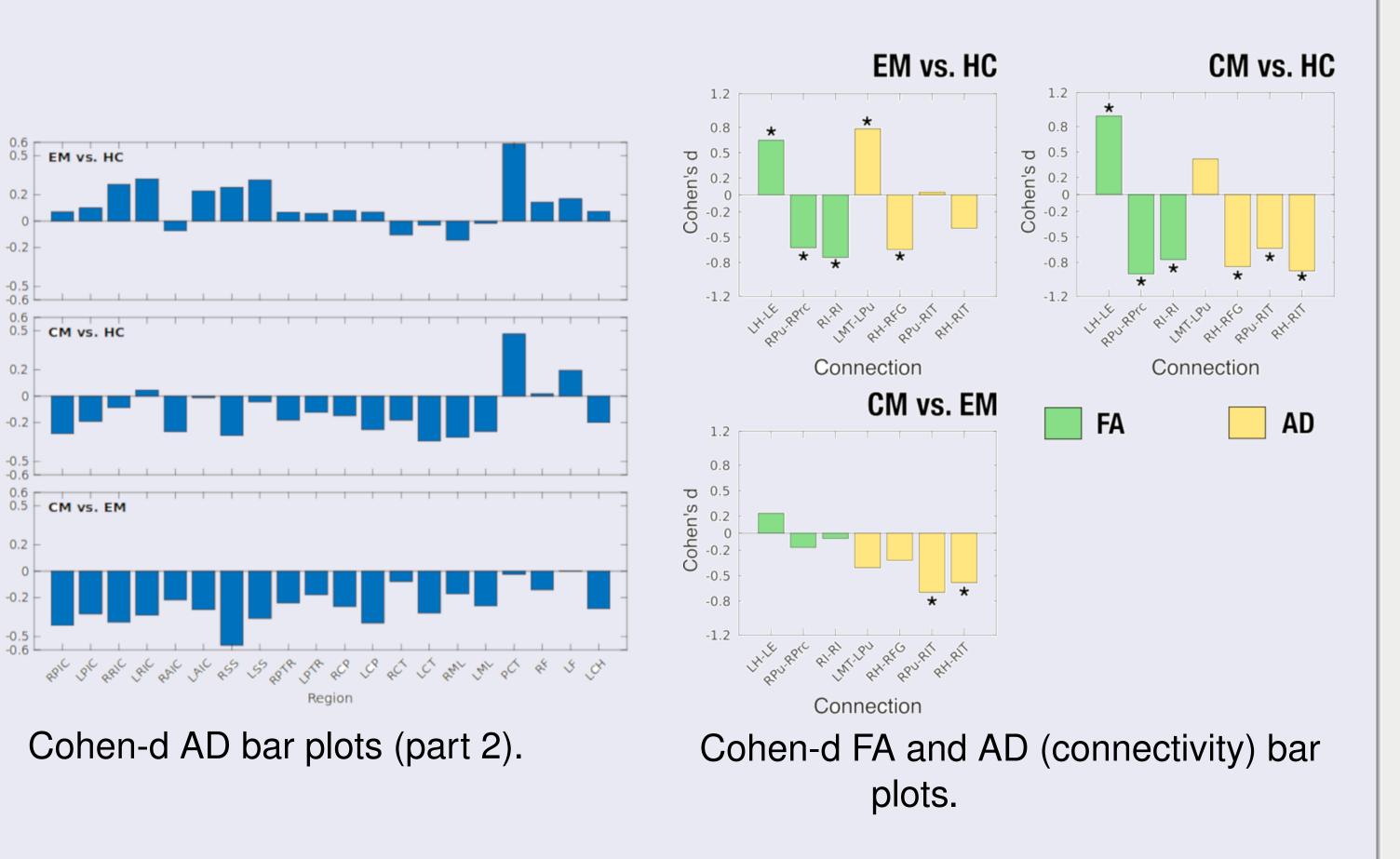
White matter alterations in CM compared to EM.





Cohen-d AD bar plots (part 1).

Cohen-d number of streamlines bar plots.



Connectomics. 18 differences in number of streamlines, 3 in FA and 4 in AD 1 Streamlines  $\rightarrow$  MIG > HC  $\rightarrow$  Pain processing regions 2 Streamlines  $\rightarrow$  MIG < HC  $\rightarrow$  Other regions

1. AD values (CM < EM)  $\rightarrow$  Transition from EM to EM  $\rightarrow$  Possible axonal impairment

2. Structural connectivity alterations in migraine with respect to healthy controls

- 2.1. Increased number of streamlines in migraine  $\rightarrow$  Regions related to pain processing
- A) Reinforcement in connections
- B) Possible counterbalance to axonal impairment

#### ACKNOWLEDGMENTS

CONCLUSIONS

Álvaro Planchuelo-Gómez was supported by Junta de Castilla y León (Spain) and the European Social Fund.

This study has been partially supported by grant from Gerencia Regional de Salud CyL (GRS 943/A/14, GRS 1727/A/18). This work was also supported by Ministerio de Ciencia e Innovacin of Spain with research grants RTI2018-094569-B-I00 and PRX18/00253 (Estancias de profesores e investigadores senior en centros extranjeros).

Streamlines  $\rightarrow$  CM > EM
FA & AD  $\rightarrow$  No clear trend (MIG > and < HC)</li>
AD  $\rightarrow$  CM < EM</li>

#### REFERENCES

Chong CD and Schwedt TJ. Migraine affects whitematter tract integrity: A diffusion-tensor imaging study. Cephalalgia 2015; 35(13): 1162-71.

Liu J, et al. The trade-off between wiring cost and network topology in white matter structural networks in health and migraine. Exp Neurol 2013; 248: 196-204.

Neeb L, et al. No microstructural White Matter Alterations in Chronic and Episodic Migraineurs: A Case-Control Diffusion Tensor Magnetic Resonance Imaging Study. Headache. 2015; 55(2): 241-51.

