

Patterns of subregional mesiotemporal disease progression in temporal lobe epilepsy

Boris Bernhardt*, Hosung Kim*, Andrea Bernasconi, Neda Bernasconi
Montreal Neurological Institute and Hospital, Montreal, Canada
MPI for Human Cognitive and Brain Sciences, Leipzig, Germany



MAX-PLANCK-GESSELLSCHAFT

Background

MRI has improved presurgical workup in drug-resistant TLE

- ▶ detection of mesiotemporal atrophy (Cascino et al. 2008)

MRI has provided evidence of disease progression

- ▶ cross-sectional MTL volumetry
(Theodore et al. 2001, Bernasconi et al. 2005)
- ▶ one previous longitudinal study focussing on hippocampus,
possible impact of progression on outcome (Fuerst et al. 2003)

No longitudinal assessment on MTL changes beyond hippocampus

Subfield topography of changes unknown: previous work has been limited to global volumetry

Purpose

Longitudinal and cross-sectional tracking of disease progression in TLE

- ▶ mapping of duration effects and within-subject trajectories

Assess the whole MTL network

- ▶ hippocampus, EC, amygdala

Subregional analysis

- ▶ Surface-shape mapping based on SPHARM-PDM

Assess relationship between progression and outcome in operated patients

Methods: study participants

Full cross-sectional sample

- ▶ 134 drug-resistant TLE (64/70 left/right; 72/62 HA/NV)
- ▶ age 36 ± 11 years, average duration 20 ± 11 years

Longitudinal subset

- ▶ 31 with repeated MRI (total 67 scans, 2.5 year interval)

Surgery

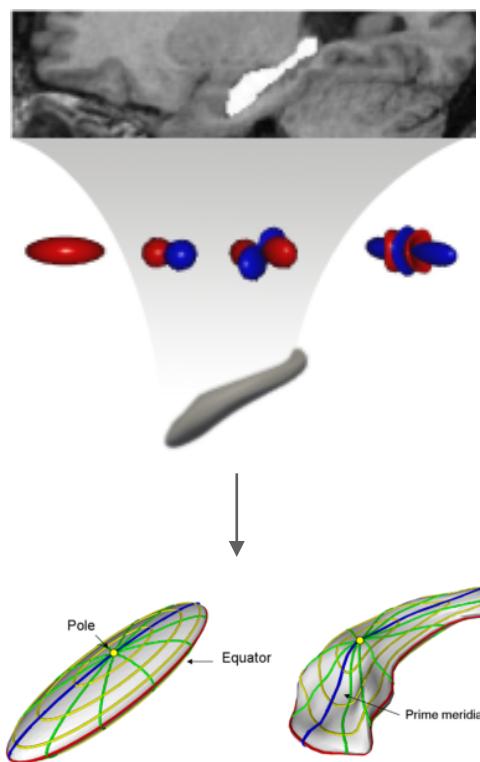
- ▶ 90/134 patients of cross-sectional sample (69% Engel-I)
- ▶ 16/31 patients of longitudinal subset (56% Engel-I)

Methods: manual MTL volumetry

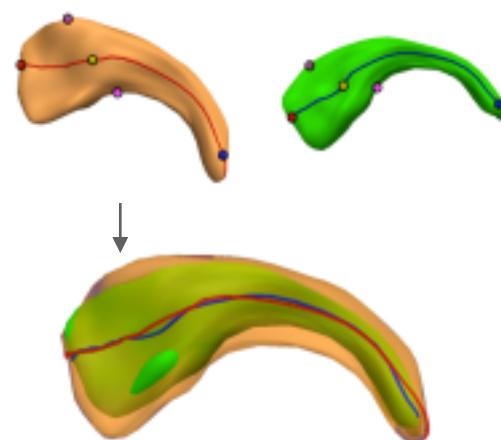


Methods: surface-based displacement vectors

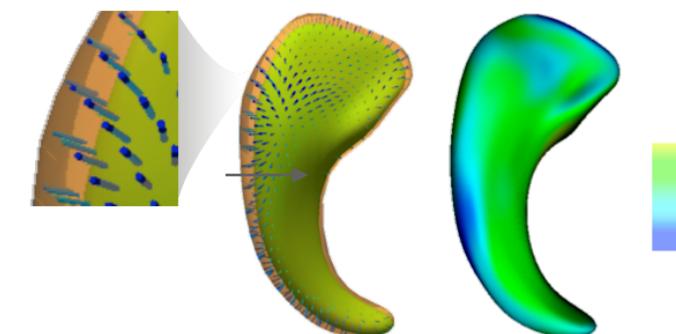
SPHARM-PDM



Alignment along long axis

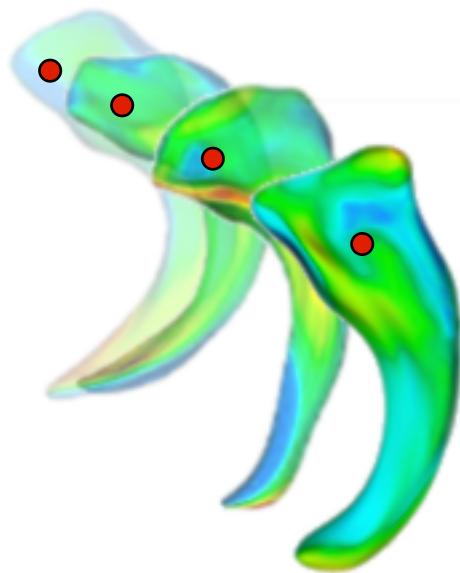


displacement from subject to template

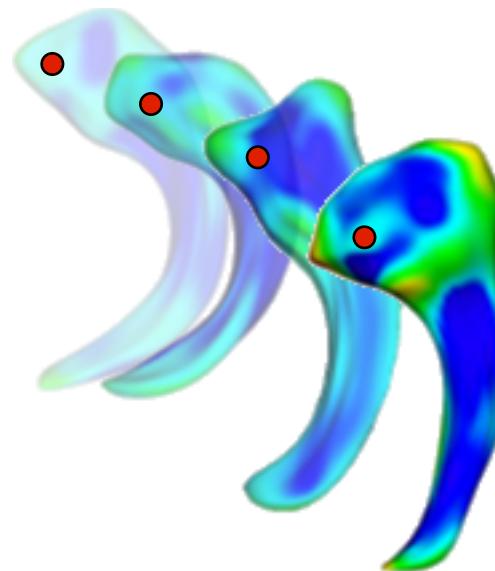


Methods: surface-based statistical analysis

short duration



long duration

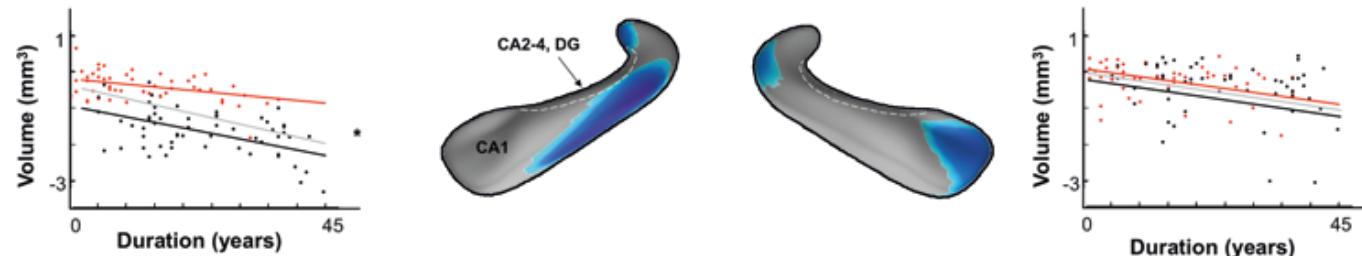


$$\text{disp} = 1 + \text{DURATION} + \varepsilon$$

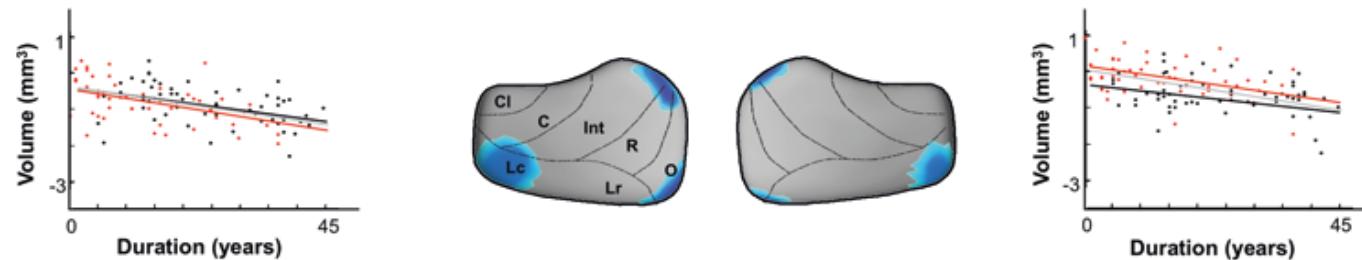
$$\text{disp} = 1 + \text{random(SUBJECT)} + \text{TIME} + \varepsilon$$

Results: cross-sectional effects of duration

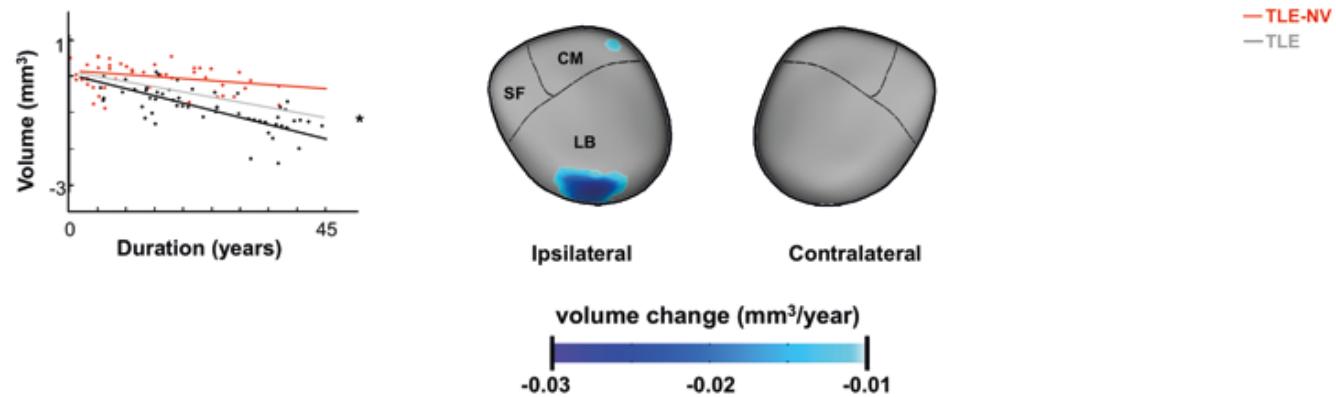
A Hippocampus (supero-lateral view)



B Entorhinal cortex (infero-medial view)

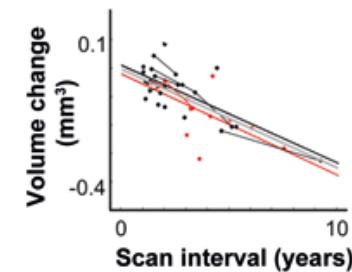
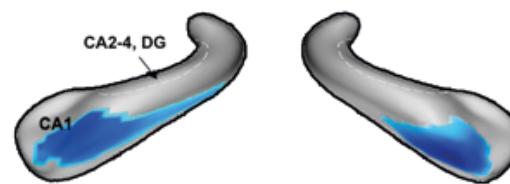
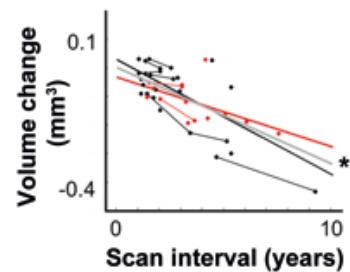


C Amygdala (posterior view)

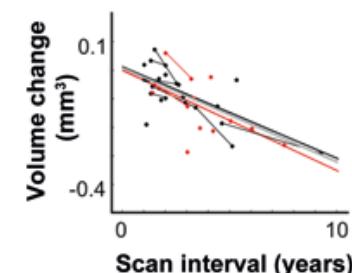
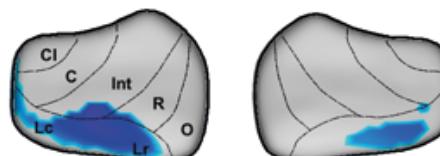
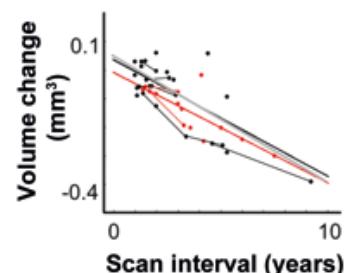


Results: longitudinal effects of inter-scan interval

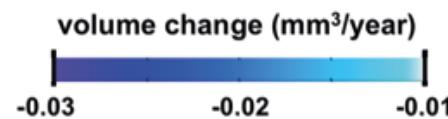
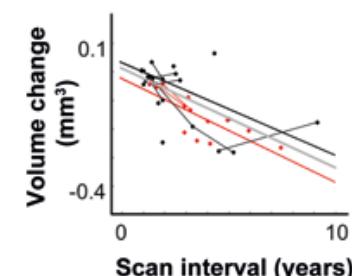
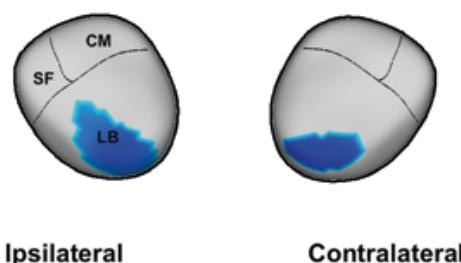
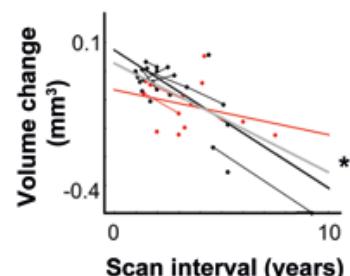
A Hippocampus



B Entorhinal Cortex

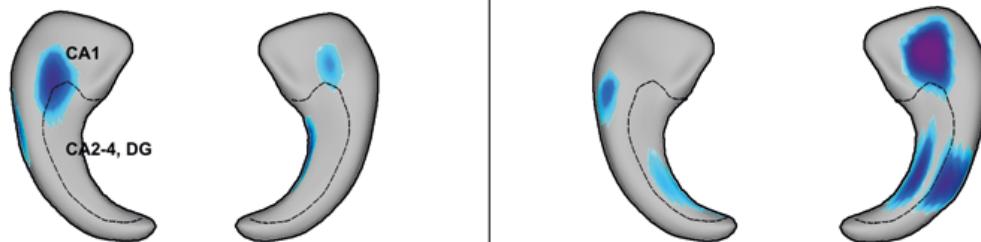


C Amygdala

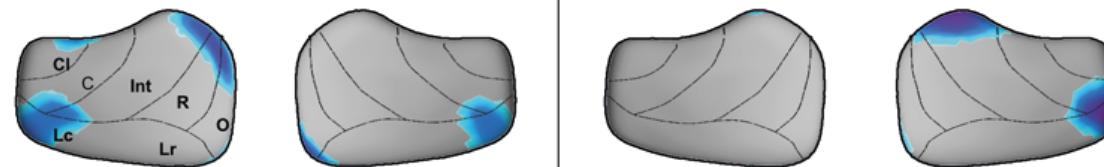


Results: effects of age

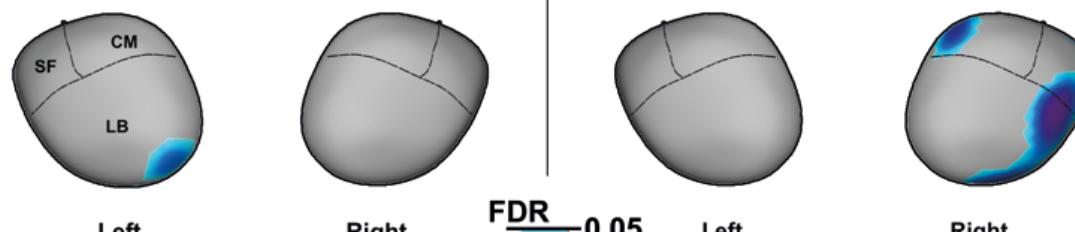
A Hippocampus



B Entorhinal cortex

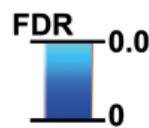


C Amygdala



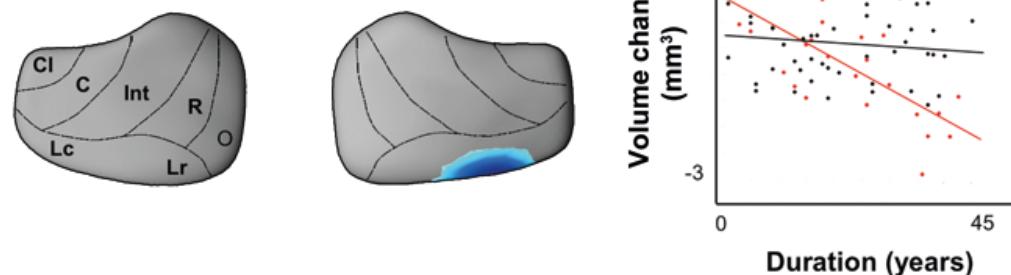
LTLE

RTLE

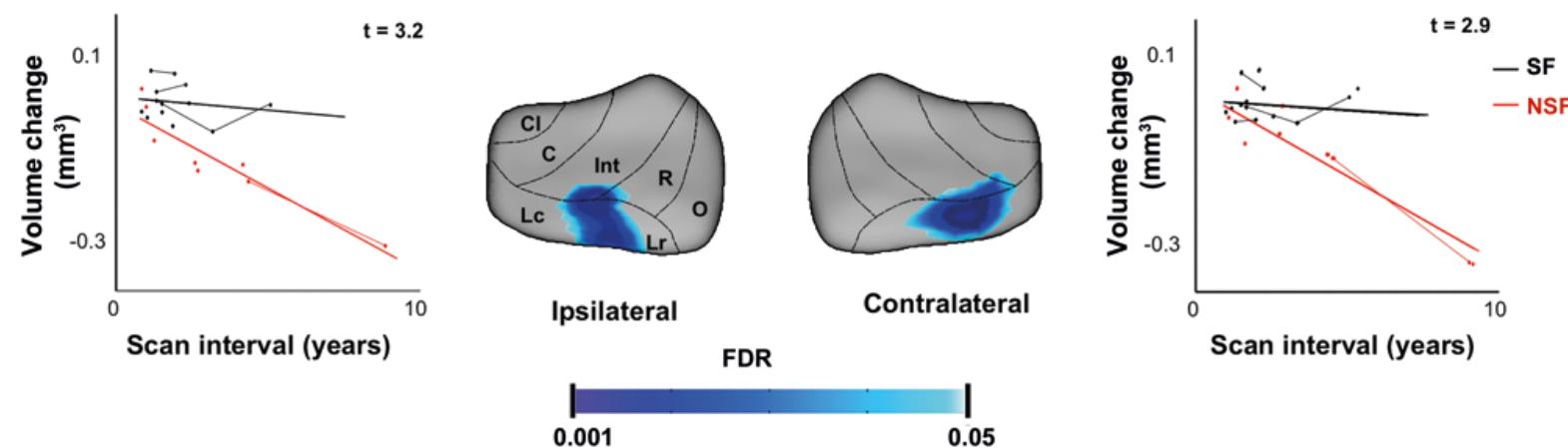


Results: relationship to post-surgical outcome

A Cross-sectional



B Longitudinal



Summary

Findings consistent in longitudinal and cross-sectional analysis

- ▶ internal cross-validation of findings

Progressive bilateral MTL atrophy:

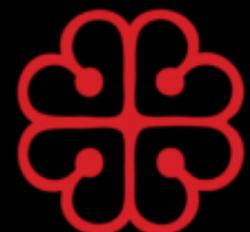
- ▶ hippocampal CA1, anterolateral EC, and laterobasal amygdala
- ▶ surface mapping enhances localization and sensitivity
- ▶ areas of histologically proven neural loss (Blumcke et al. 2007)
- ▶ motivation for early surgery in TLE (Wiebe et al. 2003)

EC progression predictive of seizure outcome after surgery

- ▶ key role of EC in TLE network
(Bartolomei et al. 2003, Bernasconi et al. 2001)

Merci!



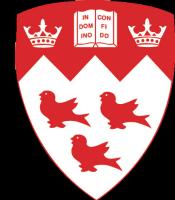
I 
MTL

Hosung Kim

Andrea and Neda Bernasconi

MNI/BIC and MPI

CIHR, SAVOY, FSRQ



MAX-PLANCK-GESELLSCHAFT