



Alterations in resting state oscillations and connectivity within sensory and motor networks in women with interstitial cystitis/painful bladder syndrome

Lisa A. Kilpatrick, Jason J Kutch, Kirsten Tillisch, Bruce Naliboff, Jennifer Labus, Zhiguo Jiang, Melissa Farmer, A. Vania Apkarian, Sean Mackey, Katherine T. Martucci, Dan Clauw, Richard E. Harris, Georg Deutsch, Timothy Ness, Claire C. Yang, Kenneth Maravilla, Chris Mullins, Emeran A. Mayer



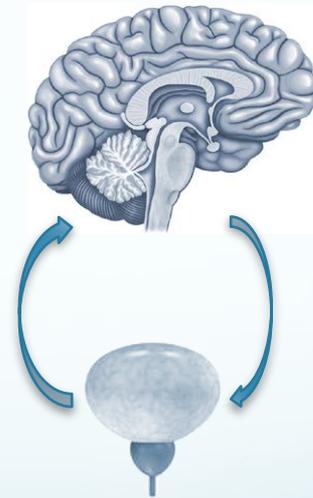
Gail and Gerald Oppenheimer Family
Center for Neurobiology of Stress



David Geffen
School of Medicine

Interstitial Cystitis/Painful Bladder Syndrome (IC/PBS)

- IC/PBS is a chronic pelvic pain condition associated with urinary urgency and frequency that may affect over 7 million women in the United States.¹
- The specific pathophysiology remains incompletely understood, but is thought to involve a central disturbance in the processing of pain and viscerosensory signals.^{2,3}



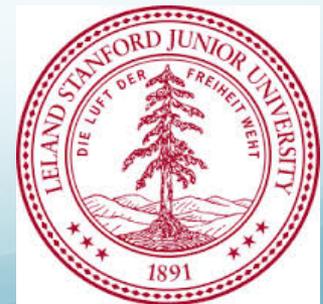
¹Berry et al (2011) J Urol

²Clemens (2008) J Urol

³Mayer & Bushnell (2009)

Multidisciplinary Approach to the Study of Chronic Pelvic Pain (MAPP) Research Network

- MAPP is a multi-site effort to identify epidemiological and neuroimaging parameters that will advance clinical phenotyping and treatment efforts for urological chronic pelvic pain, including IC/PBS
- Neuroimaging data was collected at 5 sites and included structural MRI, diffusion tensor imaging and resting scan fMRI





Resting Scan fMRI

- Resting scan fMRI capitalizes on the fact that a wealth of information can be extracted from the intrinsic fluctuations in the blood oxygen-level dependent (BOLD) signal without the need of an external stimulus.
- Advantages of resting scan over task-based fMRI include a greater degree of standardization across research centers.
- In addition, brain responses to acute, experimental pain in the laboratory may have limited utility for understanding chronic pain.



Aim of Study

- Using resting scan fMRI, we aimed to identify differences in intrinsic brain activity and connectivity between female IC/PBS patients and healthy controls
- We hypothesized that IC/PBS patients show altered oscillation frequency and functional connectivity in visceromotor regions.



Subjects

- 85 female healthy controls (HC) and 82 female IC/PBS patients collected from 5 MAPP discovery sites
- To meet IC/PBS symptom criteria, patients had to report an unpleasant sensation of pain, pressure or discomfort perceived to be related to the bladder and/or pelvic region associated with lower urinary tract symptoms.
- IC/PBS symptoms must have been present for most of the time during any 3 months in the previous 6 months and for most of the time during the most recent 3 months.



Methods: Data Acquisition

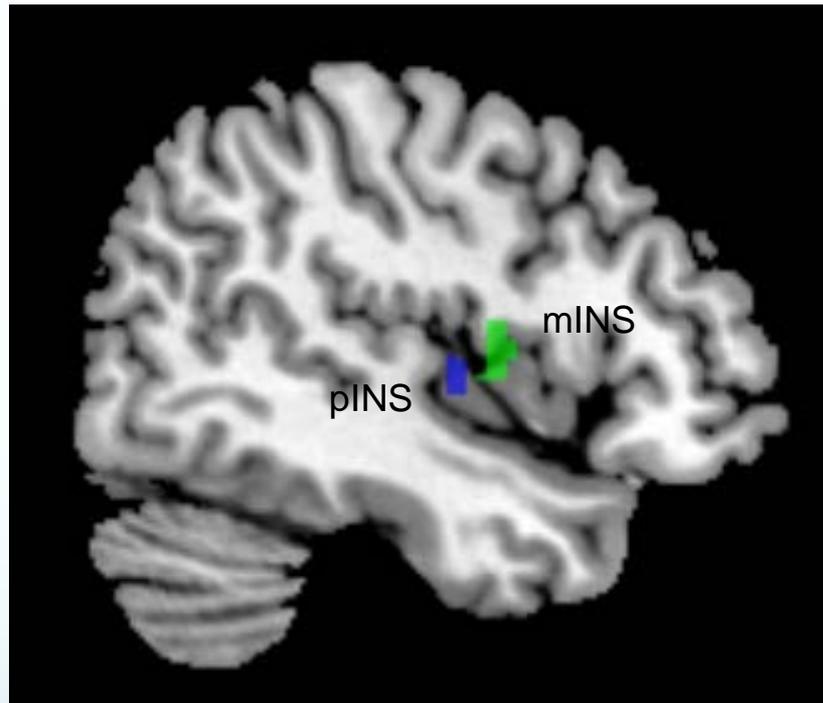
- Scanning was performed at multiple sites using different scanner technology (3T Siemens Trio (NWU and UCLA), 3T Phillips Ingenia (UM), 3T Philips Achieva (UAB), and 3T GE Discovery (SU)).
- Standardized acquisition parameters were used to collect 10 minute resting fMRI scans. During the scan subjects rested with eyes closed.
- Data was collected, quality controlled and archived according to multi-site imaging procedures developed collaboratively between the MAPP Research Network, the UCLA PAIN repository and the UCLA Laboratory of Neuroimaging.



Methods: Analyses

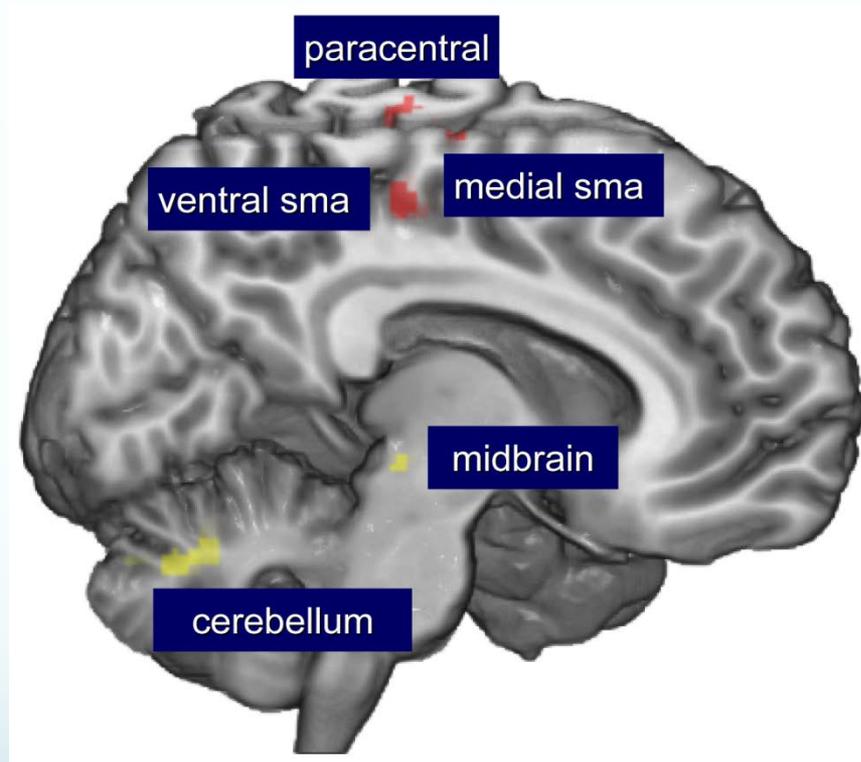
- Alterations in frequency distribution were determined by transforming the BOLD signal time course data of each brain voxel into the frequency domain and computing the fractional amplitude of frequency power in 3 frequency bands
 - LF (0.01-0.027 Hz; aka slow-5)
 - MF (0.027-0.073 Hz; aka slow-4)
 - HF (0.073-0.198 Hz; aka slow-3)
- Regions demonstrating altered frequency distribution were further examined for altered functional connectivity by computing band-specific correlation maps.

Altered insular frequency distribution and functional connectivity in women with IC/PBS compared to healthy women



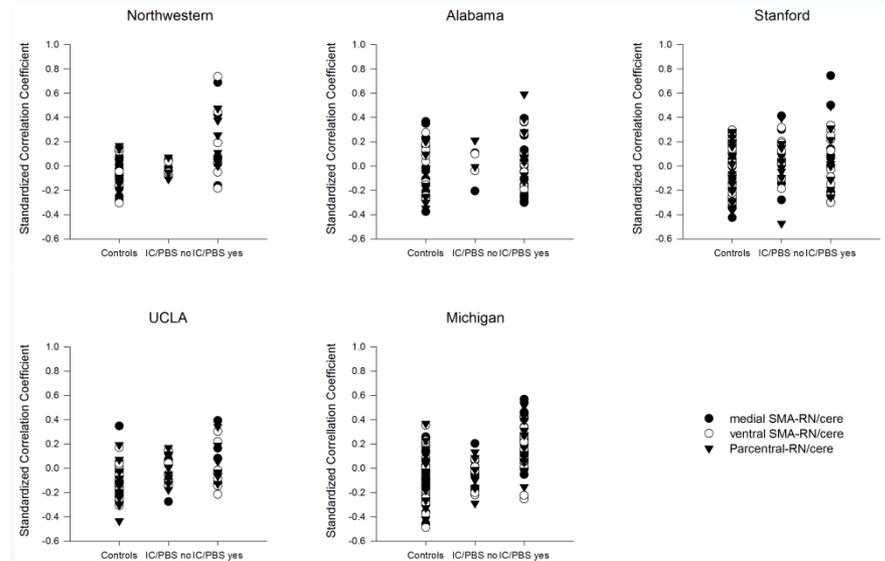
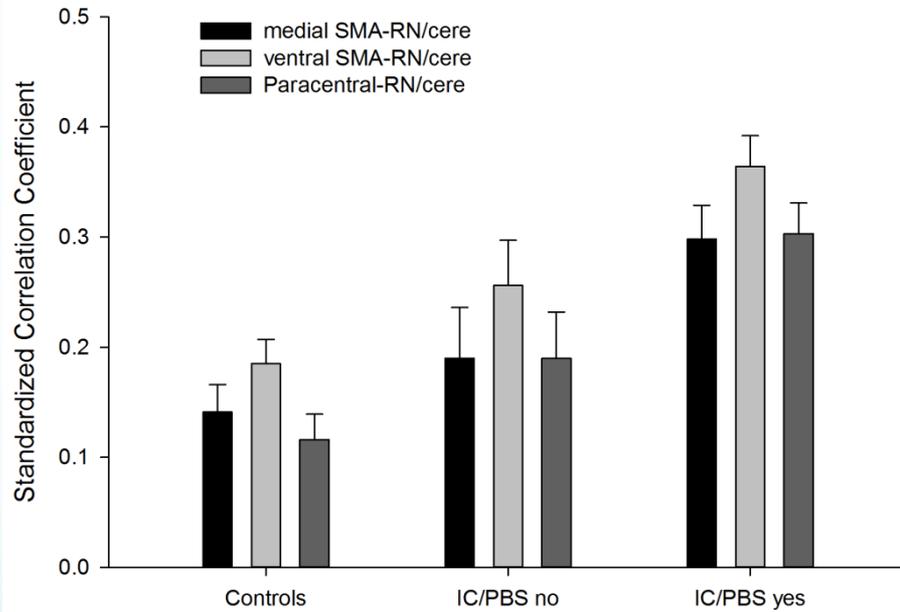
Posterior insula (pINS) shown in blue displayed decreased LF power and decreased functional connectivity with the mid insula (mINS) shown in green in IC/PBS patients.

Altered sensorimotor frequency distribution and functional connectivity in women with IC/PBS compared to healthy women



Sensorimotor regions shown in red displayed increased LF power and increased connectivity with the regions in yellow in IC/PBS patients.

Altered connectivity was greatest in patients endorsing pain during bladder filling



The connectivity between sensorimotor cortices and midbrain/cerebellular regions was greatest in patients endorsing pain during bladder filling.



Conclusions

- IC/PBS patients demonstrated alterations in viscerosensory regions which may reflect tonically increased viscerosensory input to the brain and altered integration of interoceptive information into subjective awareness.
- Several regions with known involvement in bladder function and pelvic floor muscle control demonstrated altered frequency distribution and connectivity in IC/PBS patients. Connectivity alterations were greatest in patients reporting pain during bladder filling. Although no assessment of pelvic floor dysfunction was performed in the current study, these alterations may be related to pelvic floor dysfunction as several clinical observations support the concept of altered pelvic floor activity in IC/PBS.

Conclusions

- Overall, these results suggest that women with IC/PBS have a sensorimotor component to their pathology involving alterations in a cortico-cerebellar pathway previously associated with bladder and pelvic floor function.

PAIN

PAIN AND INTEROCEPTION IMAGING NETWORK



The **PAIN Repository** is targeting collection of MRI scans from **1,000** subjects for Big Data Analysis

- Diverse chronic pain conditions and healthy controls
- Structural, DTI and resting state functional scans
- Both standardized data for multisite combination and non-standardized for meta-analysis



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PAINRepository.org
The Oppenheimer Center





University of CA, Los Angeles Center for Neurobiology of Stress

Emeran Mayer

Bruce Naliboff

Kirsten Tillisch

Jennifer Labus

Cody Ashe-McNalley

Mher Alaverdyan

Annie Gupta

Zafar Gill

Zhiguo Jiang

Jean Stains

Stanford University

Sean Mackey

Katherine T. Martucci

University of Michigan

Dan Clauw

Richard E. Harris

Northwestern University

Melissa Farmer

A. Vania Apkarian

University of Southern California

Jason J Kutch

University of Washington, Seattle

Claire C. Yang

Kenneth Maravilla

University of Alabama, Birmingham

Georg Deutsch

Timothy Ness

NIDDK

Chris Mullins

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MAPP Research Network Study Group

MAPP Network Executive Committee

J. Quentin Clemens, MD, FACS, MSci,
Network Chair, 2013-
Philip Hanno, MD
Ziya Kirkali, MD
John W. Kusek, PhD
J. Richard Landis, PhD
M. Scott Lucia, MD
Chris Mullins, PhD
Michel A. Pontari, MD

Northwestern University

Discovery Site

David J. Klumpp, PhD, Co-Director
Anthony J. Schaeffer, MD, Co-Director
Apkar (Vania) Apkarian, PhD
David Cella, PhD
Melissa A. Farmer, PhD
Colleen Fitzgerald, MD
Richard Gershon, PhD
James W. Griffith, PhD
Charles J. Heckman II, PhD
Mingchen Jiang, PhD
Laurie Keefer, PhD
Darlene S. Marko, RN, BSN, CCRC
Jean Michniewicz
Todd Parrish, PhD
Frank Tu, MD, MPH

University of California, Los Angeles **Discovery Site and** **PAIN Neuroimaging Core**

Emeran A. Mayer, MD, Co-Director
Larissa V. Rodriguez, MD, Co-Director
Jeffrey Alger, PhD
Cody P. Ashe-McNalley
Ben Ellingson, PhD
Nuwanthi Heendeniya
Lisa Kilpatrick, PhD
Jason Kutch, PhD
Jennifer S. Labus, PhD
Bruce D. Naliboff, PhD
Fornessa Randal
Suzanne R. Smith, RN, NP

University of Iowa

Discovery Site

Karl J. Kreder, MD, MBA, Director
Catherine S. Bradley, MD, MSCE
Mary Eno, RN, RA II
Kris Greiner, BA
Yi Luo, PhD, MD
Susan K. Lutgendorf, PhD
Michael A. O'Donnell, MD
Barbara Ziegler, BA

University of Michigan

Discovery Site

Daniel J. Clauw, MD, Co-Director;
Network Chair, 2008-2013
J. Quentin Clemens, MD, FACS, MSci,
Co-Director; Network Chair, 2013-
Suzie As-Sanie, MD
Sandra Berry, MA
Megan E. Halvorson, BS, CCRP
Richard Harris, PhD
Steve Harte, PhD
Eric Ichesco, BS
Ann Oldendorf, MD
Katherine A. Scott, RN, BSN
David A. Williams, PhD

University of Washington, Seattle

Discovery Site

Dedra Buchwald, MD, Director
Nilofar Afari, PhD, Univ. Of California,
San Diego
John Krieger, MD
Jane Miller, MD
Stephanie Richey, BS
Susan O. Ross, RN, MN
Roberta Spiro, MS
TJ Sundsvold, MPH
Eric Strachan, PhD
Claire C. Yang, MD

Washington University, St. Louis

Discovery Site

Gerald L. Andriole, MD, Co-Director
H. Henry Lai, MD, Co-Director
Rebecca L. Bristol, BA, BS, Coordinator
Graham Colditz, MD, DrPH
Georg Deutsch, PhD, Univ. of
Alabama at Birmingham
Vivien C. Gardner, RN, BSN, Coordinator
Robert W. Gereau IV, PhD
Jeffrey P. Henderson, MD, PhD
Barry A. Hong, PhD, FAACP
Thomas M. Hooton, MD, Univ of Miami
Timothy J. Ness, MD, PhD, Univ. of
Alabama at Birmingham
Carol S. North, MD, MPE, Univ.
Texas Southwestern
Theresa M. Spitznagle, PT, DPT, WCS
Siobhan Sutcliffe, PhD, ScM, MHS

University of Pennsylvania

Data Coordinating Core (DCC)

J. Richard Landis, PhD, Core Director
Ted Barrell, BA
Theressa Creighton, BA
Laura Fluharty, MPH
Xiaoling Hou, MS
Nancy Robinson, PhD
Alisa Stephens, PhD
Yanli Wang, MS

University of Colorado Denver

Tissue Analysis & Technology Core (TATC)

M. Scott Lucia, MD, Core Director
Adrie van Bokhoven, PhD
Andrea M. Abeyta, BS
Robert Dayton, Jr
Karen R. Jonscher, PhD
Holly T. Sullivan, BS
R. Storey Wilson, MS

Additional Sites:

Harvard Medical School/ Boston Children's Hospital

Marsha A. Moses, PhD, Director
Andrew C. Briscoe
David Briscoe, MD
Adam Curatolo, BA
John Froehlich, PhD
Richard S. Lee, MD
Monisha Sachdev, BS
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Sean Mackey, MD, PhD, Director
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Katherine T. Martucci, PhD
Rebecca L. McCue, BA
Rachel R. Moericke, MA
Aneesha Nilakantan, BA
Noorulain Noor, BS

Queens University

J. Curtis Nickel, MD, FRCS, Director

Drexel University College of Medicine

Garth D. Ehrlich, PhD

National Institutes of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health (NIH)

Chris Mullins, PhD
John W. Kusek, PhD
Ziya Kirkali, MD
Tamara G. Bavendam, MD

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