

prefrontal neurons and the genetics of schizophrenia', *Biological Psychiatry*, Vol 50, pp. 825–844.

### S69. NEURAL-SYNCHRONIZATION DURING COOPERATION TASK IN CLINICAL HIGH RISK OF PSYCHOSIS-A FNIRS-BASED HYPERSCANNING STUDY

Yanyan Wei<sup>\*1</sup>, TianHong Zhang<sup>1</sup>, LiHua Xu<sup>1</sup>, Yingying Tang<sup>1</sup>, Jijun Wang<sup>1</sup>

<sup>1</sup>Shanghai Mental Health Center, Shanghai Jiaotong University School of Medicine

**Background:** A growing evidence has been reported that patients at clinical-high risk (CHR) for psychosis showed deficits in social interaction. A pervasive challenge in social neuroscience is how to model human interactions in laboratory to study the dynamic of brain activity. Functional near-infrared spectroscopy (fNIRS) is a relatively convenient cortical imaging technology that can measuring brain activity in a more naturalistic environment. We developed a hyperscanning method to simultaneously measure brain activity in two people during a computer-based game.

**Methods:** Participants: Sixty-four adults from SHARP group (32 pairs, 15 pairs of healthy-healthy (HC-HC), mean age: 26.6±4.3, mean education: 17.1 ± 3.1; 17 pairs of healthy-CHR (HC-CHR), mean age: 24.1 ± 5.8, mean education: 15.0 ± 4.0) participated in the study. There were 7 female-female pairs and 8 male-male pairs in the HC-HC group, while 11 female-female pairs, 5 male-male pairs and 1 female-male pair in the HC-CHR group. Written informed consent was obtained from all participants, and the study protocol was approved by the ethics committee of Shanghai Mental Health Center.

**Computer-based Game:** Each pair participated in a computer-based "cooperation" and "competition" tasks, a hollow gray circle appeared and remained on the screen. After a random delay of 0.6–1.5 s, the gray circle filled with a green circle ('go' signal). The participants were instructed to press their response keys only after the 'go' signal. The participant on the left was instructed to use the '1' key, the right use the '0' key. We will denote the time between the 'go' signal and the key press as the "response time." If the difference between the response times of the two participants was smaller than a threshold, both participants earned one point; otherwise they both lost one point. They were instructed to maximize the number of points earned. While competition task, participants were instructed to respond faster than their partners

**NIRS data acquisition:** ETG-4000 (Hitachi, Japan) was used to measure the concentration changes in oxygenated hemoglobin (oxy-Hb) and deoxygenated hemoglobin (deoxy-Hb). A single "3×5" patch consisting of 8 emitters and 7 detectors was positioned on each participant's forehead resulting in 22 measurement channels. The patch placement was based on the 10–20 system. Wavelet coherence was used to assess relationships between NIRS signals by a pair of participants.

**Results:** Reaction time among participant pairs between competition and cooperation task showed no significant ( $t=-0.854$ ,  $p=0.396$ ). HC-HC group showed higher success rate during the cooperation task ( $t=2.525$ ,  $p=0.017$ ). For each channel, after converting the synchronization increase into a Z value. Based on uncorrected p value, a significant activation coherence in channel 3 ( $t=4.65$ ,  $p=0.02$ ), channel 9 ( $t=8.17$ ,  $p=0.009$ ) and channel 14 ( $t=5.72$ ,  $p=0.025$ ) were found between groups. After correction there is no significant activation coherence.

**Discussion:** The technique of hyperscanning is a new method to study the neural-synchronization in CHR. This just was a preliminary result. Because of the limitation of sample size, we just observed a meaningful activation coherence based on uncorrected p value. Our study is still going on and intends to collect 30 HC-HC dyads and 30 HC-CHR dyads. When completed we will reanalyze the data and wish to report on the SIRS.

### S70. INDIVIDUALIZED DIAGNOSIS OF PSYCHOSIS BASED ON MACHINE LEARNING FROM FUNCTIONAL MAGNETIC RESONANCE DATA USING AN EMOTIONAL AUDITORY PARADIGM

Julio Sanjuan<sup>\*1</sup>, Maria Jose Castro-Bleda<sup>2</sup>, Salvador España-Boquera<sup>2</sup>, Gracian Garcia-Marti<sup>3</sup>, Jose Miguel Carot<sup>2</sup>, Iluminada Corripio<sup>4</sup>, Pau Soldevila-Matias<sup>5</sup>, Luis Marti-Bonmati<sup>6</sup>, Jose Manuel Rubio<sup>7</sup>, Benedicto Crespo-Facorro<sup>8</sup>  
<sup>1</sup>Valencia Faculty of Medicine; <sup>2</sup>Universitat Politècnica de València; <sup>3</sup>CIBERSAM; <sup>4</sup>Hospital San Pau, CIBERSAM; <sup>5</sup>Clinic Hospital Valencia, INCLIVA; <sup>6</sup>Hospital la Fe; <sup>7</sup>Feinstein Institute for Medical Research; <sup>8</sup>Marques de Valdecilla, Hospital, CIBERSAM

**Background:** Recently there has been an increasing interest in the use of machine learning techniques to neuroimaging data, in order to discriminate patients with schizophrenia from healthy control. However, until now, these tools have not been useful enough to be integrated into the clinical practice (Arbabshirani MR et al 2016). In the last 10 years we have been using an fMRI auditory emotional paradigm specifically designed for psychosis (Sanjuan et al 2007). This paradigm showed sensitivity to detect changes in brain activation after CBT treatment in patients with persistent auditory hallucinations (Aguilar et al 2018).

**Objective:** Discriminate patients with Non-affective Psychosis from healthy controls employing Machine Learning in a fMRI database (with the Emotional Auditory Paradigm).

**Methods:** Sample: 122 patients with the diagnosis of Non-affective psychosis according to DSM-IV criteria, and 49 healthy controls, from two different samples of Valencia Clinic Hospital (Spain) and Barcelona San Pau Hospital (Spain). 37 patients and 21 healthy controls come from Valencia, and 85 patients and 28 healthy controls come from Barcelona. fMRI Paradigm: Four blocks of stimuli, 20 s each, interleaved with another four blocks of rest of 20 s each, were presented to patients and controls. Each block had 13 words, 2 with emotional content and 2 with 13 emotional neutral words (Sanjuan 2007).

**Machine Learning Method:** Several measures were extracted from the fMRI images for a total of 312 characteristics. These characteristics are statistical parameters extracted from the percentage of brain activation change for all anatomical areas: amygdala, lower front, medium frontal, superior front, insula, lower temporary, temporary average, superior temporary, cingular, hippocampus. The following statistical descriptors were collected for each area and zone: mean, median, standard deviation, asymmetry, kurtosis and others related to these ones. Machine learning techniques were applied, in particular, Support Vector Machines (SVM) (Schölkopf and Smola, 2018), to this data. An exhaustive scanning of the parameters C and Gamma of the Radial Basis Function kernel SVM was performed.

**Results:** The obtained accuracy for an experiment using all data with a cross validation with 25 splits was 77%. If we separate samples from each hospital, we obtained an accuracy of 84% for Barcelona and 71% for Valencia.

**Discussion:** These preliminary results with a very passive, simple, short paradigm in different samples suggested, this method combining the emotional auditory paradigm with machine learning technique may be useful as clinical state biomarker in daily diagnosis practice. Although other Machine Learning Machine Techniques and replications in different larger samples are needed before filling the gap between research and clinical practice. Furthermore, these results indicate that this methodology may help elucidate pathophysiological mechanisms in psychoses.

#### References:

Arbabshirani MR, S P J Sui, V D. Calhoun Single subject prediction of brain disorders in neuroimaging: Promises and pitfalls *NeuroImage* 145 (2017) 137–165

Sanjuan J; Lull JJ; Aguilar EJ; Martí-Bonmati L; Moratal D; Gonzalez JC; Robles M; Keshavan MS. Emotional words induce enhanced brain

activity in schizophrenic patients with auditory hallucinations. *Psychiatry Research*. 2007, 154, pp. 21 - 29.

Aguiar EJ, et al Emotional fMR auditory paradigm demonstrates normalization of limbic hyperactivity after cognitive behavior therapy for auditory hallucinations. *Schizophr Res*. 2018;193:304–312.

Schölkopf B, Smola A. *Learning with Kernels: Support Vector Machines, Regularization, Optimization, and Beyond*, MIT Press, 2018.

### S71. NEUROVASCULAR UNCOUPLING IN SCHIZOPHRENIA: A BIMODAL META-ANALYSIS OF BRAIN PERFUSION AND GLUCOSE METABOLISM

Niron Sukumar<sup>1</sup>, Priyadharshini Sabesan<sup>2</sup>, Lena Palaniyappan<sup>\*1</sup>

<sup>1</sup>University of Western Ontario; <sup>2</sup>London Health Science Center

**Background:** Since the time of Ernst von Feuchtersleben who coined the term psychosis (1845), psychotic disorders have been suspected to be associated with disturbances in cerebral blood supply. The use of modern neuroimaging approaches has uncovered abnormalities in the resting-state regional cerebral blood flow (rCBF) across various brain regions in schizophrenia. In a healthy brain, rCBF is tightly coupled to resting cerebral glucose metabolism (rCMRglu), which increases with synaptic activity. The coupling of rCBF (measured using arterial spin labelling, ASL) and rCMRglu (measured using 18fluorodeoxyglucose positron emission tomography, FDG-PET) depends on the integrity of the neurovascular unit. In schizophrenia, several lines of evidence point towards aberrant neurovascular coupling especially in the prefrontal regions, though no simultaneous ASL-PET studies identifying regions with concordance or discordance between metabolism and perfusion have been reported to our knowledge. To address this gap, we undertook a voxel-based bimodal meta-analysis to examine the relationship between rCBF and rCMRglu in schizophrenia. We hypothesized that several brain regions would show combined abnormalities of perfusion and metabolism, while uncoupling of these 2 parameters will be observed in prefrontal regions.

**Methods:** We undertook a systematic literature search to include all available studies reporting voxelwise ASL or FDG-PET changes in schizophrenia using coordinates based multimodal meta-analysis implemented using Signed Differential Mapping (SDM) software. 31 studies met the inclusion criteria, comprised of data from 599 patients and 590 controls, available for meta-analysis. We used conjunction and moderator analyses to evaluate areas with concordant and discordant abnormalities in rCBF and rCMRglu respectively. We also undertook meta-regression analyses to study the effect of age, gender, duration of illness, anti-psychotic dosage, and illness severity on the illness-related changes in rCBF and rCMRglu.

**Results:** Among patients with schizophrenia, we observed a conjoint reduction in rCBF and rCMRglu in the left fronto-insular cortex and bilateral dorsal anterior cingulate cortex ( $z > 2$ , cluster inclusion  $p < 0.0001$ ). A conjoint increase in rCBF and rCMRglu was noted in bilateral striatum and temporal pole. Regional neurovascular uncoupling was notable in the superior frontal gyrus (reduced rCMRglu, normal rCBF) and cerebellum (increased rCMRglu, normal rCBF). Meta-regression analyses were unstable due to the low number of eligible studies.

**Discussion:** Our results suggest that several key regions implicated in the pathophysiology of schizophrenia such as the fronto-insular cortex, dorsal ACC, putamen and temporal pole (constituting the regions of the Salience Network) show conjoint metabolic and perfusion abnormalities in patients. In contrast, discordance between metabolism and perfusion was seen in the superior frontal gyrus and the cerebellum, indicating that factors contributing to neurovascular uncoupling (e.g. inflammation, mitochondrial dysfunction or oxidative stress) are likely to operate at these loci. Hybrid ASL-PET studies focusing on these regions could confirm our proposition.

### S72. FUNCTIONAL DISCONNECTION WITHIN THE PRESENCE HALLUCINATION NETWORK IN PSYCHOTIC PATIENTS WITH FIRST-RANK SYMPTOMS

Giedre Stripeikyte<sup>\*1</sup>, Giulio Rognini<sup>1</sup>, Nathan Faivre<sup>1</sup>, Jevita Potheegadoo<sup>1</sup>, Pierre Progin<sup>2</sup>, Patric Hagmann<sup>3</sup>, Philippe Conus<sup>4</sup>, Kim Q. Do<sup>5</sup>, Olaf Blanke<sup>6</sup>

<sup>1</sup>Center for Neuroprosthetics (CNP), Laboratory of Cognitive Neuroscience (LNCO), Ecole Polytechnique Fédérale de Lausanne (EPFL); <sup>2</sup>Centre Hospitalier Universitaire Vaudois (CHUV), EPFL; <sup>3</sup>Signal Processing Laboratory, EPFL; <sup>4</sup>Lausanne University; <sup>5</sup>Center for Psychiatric Neuroscience, Lausanne University Hospital; <sup>6</sup>EPFL, University Hospital of Geneva (HUG)

**Background:** Psychosis is an abnormal mental state including hallucinations and delusions, typical of psychiatric conditions such as schizophrenia. Recent theories posit that psychosis is driven by inaccurate sensorimotor predictions causing the misattribution of self-related events to external sources. This misattribution has been linked to first-rank symptoms (FRS), including a loss of sense of agency and, particularly, the occurrence of an alien agent. The subjective experience of an alien agent while no one is actually there is called presence hallucination (PH). PH has been observed in schizophrenia, Parkinson's disease and neurological patients with circumscribed brain lesions. In healthy participants, PH can be induced by exerting sensorimotor conflicts between the participants' upper-limb movements and a tactile feedback received on the back using MRI-compatible robotics. Crucially, the neural network associated with this robotically-induced version of PH overlap with the symptomatic-PH network derived from neurological patients suffering from PH in right dorso-lateral prefrontal cortex (dlPFC) and middle temporal gyrus (MTG), suggesting a common neural mechanism (PH network).

**Methods:** Given that experiencing an alien agent is a specific feature of FRS, we tested whether bilateral functional connectivity in PH network comprising of dlPFC and MTG can specifically differentiate psychotic patients with (N = 39) versus without (N = 24) FRS.

**Results:** We observed reduced functional connectivity in patients with FRS as compared to patients without FRS between the right MTG and the dlPFC bilaterally. Interestingly, connectivity between these areas was negatively correlated with the FRS severity ( $\rho = -0.29$  and  $\rho = -0.26$ , respectively).

**Discussion:** We propose that reduced functional connectivity between the right MTG and bilateral dlPFC areas could be a specific biomarker of first rank symptoms in patients with psychosis.

### S73. ABNORMAL ACTIVATION WHEN ENVISIONING POSITIVE FUTURE EVENTS IN INDIVIDUALS WITH SOCIAL ANHEDONIA

Zhuoya Yang<sup>\*1</sup>, Ruiting Zhang<sup>1</sup>, Yongming Wang<sup>2</sup>, Jia Huang<sup>1</sup>, Hanyu Zhou<sup>1</sup>, Dost Ongur<sup>3</sup>, Raymond Chan<sup>1</sup>

<sup>1</sup>Institute of Psychology, Chinese Academy of Sciences; <sup>2</sup>Institute of Psychology, Chinese Academy of Sciences; Sino-Danish College; <sup>3</sup>McLean Hospital, Harvard Medical School

**Background:** Pre-experiencing positive future episodes, which is an important underlying process of anticipatory pleasure, is impaired in individuals with social anhedonia (SocAhn). This study aimed to examine neural correlates engaging in the construction and elaboration of positive future events in individuals with SocAhn.