Anomalous cognitive and re-experiencing Networks in recent onset Post-Traumatic Stress Disorder

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Purpose: Neuroimaging studies have shown that post-traumatic stress disorder (PTSD) is accompanied by structura and functional abnormalities in specific brain regions and connections. However, alterations of the topologica organization of these regions or network-level structural aberrations are still poorly understood.

Methods: The cortical networks were studied in fifteen recent onset PTSD patients suffered from single prolonge trauma exposure and demographically similar twenty-five healthy controls. Cortical networks were constructed b thresholding correlation matrices of 150 regions and quantified using graph theoretical approaches. The contribution of high-degree nodes, the regional and global network measures, including degree (number of connections in a node and betweenness (fraction of short path connections in a node) were studied.

Results: Fig.1 shows a flowchart for the construction of structural cortical networks. Compared with healthy control PTSD patients showed altered quantitative values in the global network properties, characterized by shorter path length and higher clustering. Moreover, PTSD patients exhibited decreased connectivity in right lingual gyrus, parahippocampal gyrus, left supramarginal gyrus, parahippocampal gyrus; bilateral superior and inferior frontal gyrus, superior frontal gyrus, posterior cingulate gyrus. The nodal centrality decreased predominantly in the occipital regions (lingual gyrus) and the default-mode regions, including the middle frontal, inferior frontal, which may associated with cognitive impairment; and increased correlations and centralities in the medial temporal lobe and posterior cingulate cortex , which may result the re-experiencing of painful memories(Fig.2).

Conclusions: Networks of PTSD patients exhibited a less efficient organization involving decreased and increase regional connectivity compared with control subjects. Regional connections related to the fear-processing an re-experiential-processing cortex may play a role in maintaining or adapting to PTSD pathology.

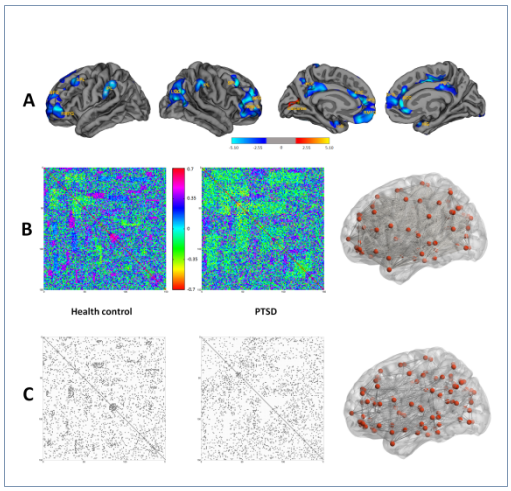

Figure1.

A, Indicated regions in yellow illustrate where the cortices of PTSD patients are thicker than that of the normal controls at corrected P<0.05 (FDR corrected)

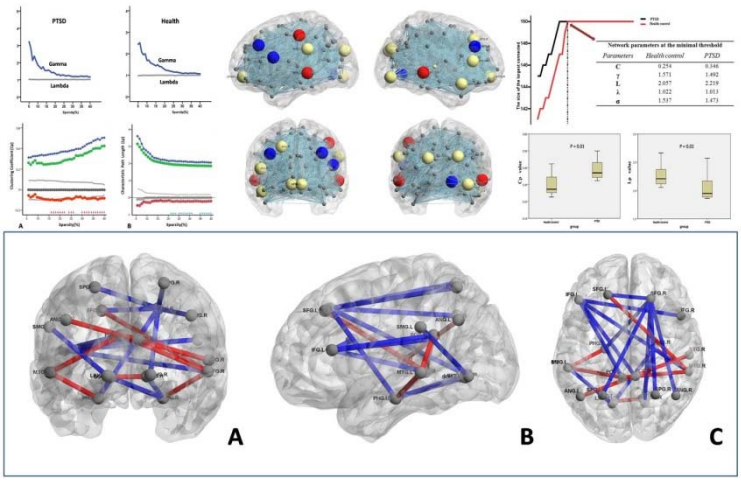

Figure 2.The graphs show the changes in the γ (C_p^{real}/C_p^{random}, gray lines) and λ (L_p^{real}/L_p^{random}, blue lines) in the cortical networks of both the control (left panel) and PTSD (right panel) groups as a function of sparisty thresholds(5%~40%).At a wide range of sparsity, both networks have $\gamma > 1$and $\lambda \approx 1$ which implies prominent small world properties. The middle show between-group differences in areas under the clustering coefficient (Cp) and path length (Lp) curves, The bigger size represents the Hubs(bi>1.5), the blue nodes represent the betweenness centrality decreased in PTSD, the red nodes represent the betweenness centrality increased in PTSD, and the yellow nodes represent the betweenness centrality were not statistically significant between two groups.