Brain networks associated with disruptive behavior in children with Tourette syndrome

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Background:
Irritability and low frustration tolerance are common features in children with Tourette syndrome. Often, these symptoms result in disruptive behaviors such as anger outbursts, aggression, and noncompliance. For many children with TS and their family, disruptive behaviors are also among the most debilitating symptoms associated with TS. However, very few studies have investigated the neural correlates of disruptive behaviors in TS. In this study, we wished to assess the brain networks associated with the severity and the interference caused by disruptive behaviors in children with TS.

Methods:
Sixty-eight children with TS were included in this study. Disruptive behaviors were assessed with the severity and interference scales of the Disruptive Behavior Rating Scale (DBRS). The severity scale has 8 items assessing the presence of symptoms of oppositional defiant disorder and 8 items assessing the degree of interference of disruptive behavior with children's functioning in various settings. EEG was recorded during a 7-minute eyes-open resting-state session. Source activity was reconstructed from the continuous EEG data and was projected onto the Desikan-Kiliany atlas. Connectivity between brain sources was computed in the alpha frequency band using the phase-locking value. Network-based statistics were used to assess the correlation between disruptive behaviors and functional connectivity.

Results:
Network-based statistics did not reveal a subnetwork that was significantly associated with the severity scale of the DBRS. However, there was a subnetwork which was negatively associated with the interference scale of the DBRS ($p = .028$). That subnetwork comprised 4 connections between 5 brain regions. Of note, the bilateral ventromedial prefrontal cortex and dorsal anterior cingulate were part of that subnetwork.

Conclusions:
Our results suggest that disruptive behaviors in TS are associated with reduced functional connectivity between the ventromedial prefrontal cortex and the dorsal anterior cingulate. Such connectivity pattern is similar to previous studies in children with disruptive behavior without tics. The ventromedial prefrontal cortex and the dorsal anterior cingulate cortex are involved in emotion processing and regulation, and reduced connectivity between these regions may lead to disruptive behaviors in children with TS.