Child’s Brain May Adapt to Control Tourette Tics

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children with Tourette syndrome appear to undergo changes in brain structure and function that allow them to gain control over their symptoms, according to a prospective study.

These changes, manifested by faster manual response times to tasks presenting conflicting information, lend strength to the premise that children with Tourette syndrome have a “generalized increase in cognitive control over motor activity” because of their constant need to suppress tics, wrote Stephen R. Jackson, Ph.D., of the University of Nottingham and his associates (Curr. Biol. 21:1064-1069, 2011).

The enhanced motor control that Dr. Jackson and his colleagues observed in children with Tourette syndrome was associated with changes in brain white matter microstructure within the prefrontal cortex and greater motor-related activity in the prefrontal cortex.

The investigators conducted a manual task-switching experiment on 13 children (including two females) at an average age of 14 years who had Tourette syndrome and 13 age- and gender-matched neurologically healthy children. None of the children had attention-deficit/hyperactivity disorder or obsessive-compulsive disorder.

In “pure block” trials, the children were presented with a green arrow pointing either right or left. They had to respond as quickly as possible by pushing a corresponding right or left key. When the arrow was red, the investigators asked the participants to push the key for the opposite direction. “Mixed block” trials included those in which green or red arrows could be randomly shown. These trials were repeated during functional MRI studies measuring blood oxygen level-dependent (BOLD) activation.

Both groups had similar response times in pure block trials and similar error rates in both types of trials. But Tourette children had significantly faster response times in mixed block trials. Tourette children also had significantly faster response times in mixed block trials when the type of key press that was required differed from that of the previous trial. This reduced response time to switching manual tasks was strongly and positively associated with tic severity as measured by the motor score on the Yale Global Tic Severity Scale, and greater clarify of how tics are controlled over time in children with Tourette syndrome.

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ADVISER’S VIEWPOINT

Study Finds Altered Activity

Tourette syndrome (TS) is an age-dependent movement disorder characterized by simple and/or complex motor and vocal tics that have occurred intermittently over a 1-year period. Motor tics usually begin at 3-5 years of age followed by onset of vocal tics several years later. In the mid- to late teen years, approximately one-third of children will stop and have complete resolution of their tics, with another third experiencing significant decrease in tic symptoms. Although TS occurs in approximately 1%–2% of the pediatric population, it is estimated that as many as 20% of children will have a motor or vocal tic. An important feature of tic phenomenology is the ability of the individual to temporarily suppress the tic if the effort is sustained, the affected individual may report mental fatigue or exhaustion.

Thus, tics appear to follow a neuromotor sequence characterized by specific ranges of onset, peak, and resolution or amelioration. The latter has given rise to the concept that tics are a “normal” part of the developmental process. That process can be considered part of the adolescents’ progressive command of motor, behavioral, and emotional experiences. Dysregulation of these complex control processes can result in the occurrence of the attentional disorders, impulsivity and hyperactivity, and the obsessive thoughts and compulsive actions that are the major comorbidities of TS.

One way to conceive of the active control processes that must take place during development is an alteration in neuronal function and perhaps anatomy, that is, neuroplasticity. As neurologists, we tend to think of neuroplasticity as the brain’s response to acquired damage such as stroke or traumatic brain injury or recovery from resective surgery. However, the alteration of brain physiology and anatomy based upon activity in a pathway or network is an fundamental property that literally shapes the nervous system during development. Just as apoptosis eliminates neurons, activity in circuits increases synaptic strength and preservation of the involved neural elements.

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