Good Student

Psych 2301 MWF 8:00

Professor Hutchinson

“Neural Substrates of Self-Regulatory Control in Children and Adults with Tourette Syndrome”

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Introduction:

While the symptoms of Tourette Syndrome (TS) fluctuate throughout the patient’s life, it is popularly accepted that the most active point is in the early 20’s. In most cases, symptoms begin to wane from that point on. However, there are cases where symptoms continue in severity throughout the lifetime of the patient. It is this anomaly that is the focal point of new research for new and better treatments for TS. Special attention is paid to the differences between the function and structure of the brain in patients with longer lasting severe systems, and the brains of those patient’s who’s symptoms diminish after their mid-twenties. It is thought that a lack of caudate nuclei may be the cause of tic symptoms as well as a factor that determines the length of time they persist. Studies that used neuroimaging have found that children with TS may be able to better control their tics through plastic changes in certain parts of the brain. It is thought that this process may be diminished in adults with persistent cases of TS thereby leaving them with less voluntary control of their TS. (Raz et al., 2009)

The hypothesis of this study is that adults with persistent cases of TS would use their frontal neurological pathways to process the Simon task more often than the children with TS. In other words, since the children have developed a system in their brains to better control their TS, they would rely less on their frontostriatal processing system as opposed to the adult who have not developed these adaptations. This same process was also hypothesized to be different from the control subjects that do not have TS. This is an experimental design based study due to the fact that the researchers took subjects with TS, as well as subjects who did not have TS, and administered the same tests to each to compare results. This study seeks to prove causation as to why some patients have a continuing severe case of TS while the majority of patients do not.
The independent variable within the study is Simon test administered and the dependent variable is type of neurological processing used. (Raz et al., 2009)

Methods:

Because this was to be an experiment based study, candidates needed to be chosen. In order to make the experiment as thorough as possible, great pains were taken to screen participants to make sure they fit the requirements for TS. Therefore, participants with TS were chosen from the Tic Disorder Specialty Clinic based at Yale in Connecticut. Each person met the requirements for TS based on the DSM-IV definition. In all, there were a total of 42 participants with TS. There were 24 children and 18 adults both male and female. A control group was also gathered from the same zip code as the TS participants. These names were collected from a list of 10,000 that was bought from a telemarketing company. Names were randomly selected. (Raz et al., 2009)

To make sure that the control group was a true control group, each person was screened for TS as well as other mental disorders. Any person who reported such problems was immediately excluded. Also, if any of the participants in either group had a history of head injuries, substance abuse, or IQ results of less than 75 they were immediately excluded. Of the ten percent of people that agreed to participate from the control group, 37 participants were chosen. There were 19 children and 18 adults both male and female. All procedures were approved by a review board and written consent was given by all involved. (Raz et al., 2009)

The test used in this experiment was called the Simon Task. All participants were hooked up to an fMRI machine and shown pictures of white arrowheads that were pointing either left or right. The screen was divided by a crosshair and the arrows were in one of two pre-
determined positions. The majority of the arrowheads were placed congruently with their
direction. In other words, if the arrow was pointing right, it would be placed on the right side of
the crosshair and vice versa. However, there was a small percent of incongruent pictures, ones
that were pointing one direction but placed on the opposite side of the crosshairs. In each session,
there were 102 pictures of the arrowheads. Placed randomly every 13 to 16 congruent
arrowheads was one incongruent one. So, approximately 6 to 7 incongruent arrowheads were
shown in each run. Each participant would respond as quickly as possible as to which way the
arrowhead was pointing by pressing one of two arrow keys on a response box. The buttons were
similar to arrow keys on a computer. (Raz et al., 2009)

While the participants were performing the Simon Task, the fMRI machine was taking
scans of their brains. Brain activity would show up as highlighted areas on the scanner. The
object of the scans was to see which sections of the brain lit up during the tests. This would give
the researchers a map of how the person’s brain was processing the task. (Raz et al., 2009)

Discussion:

As hypothesized, greater frontostriatal use was shown in adults with TS than in children
in TS. However, greater frontostriatal uses was shown in both the control group and the TS group
of adults. It is known that as children grown into adults, their brains start to use more frontostriatal
processing and less scattered means of self-regulatory control. This shift is thought to allow for
more efficient processing of repetitive tasks. Keeping this in mind, when TS adults were
compared to the control adults, more exaggerated frontostriatal processing was shown. This is
believed to be a compensatory factor. (Raz et al., 2009)
Since adults with TS have to work to self-control their tics, the frontal region of the brain light up on the fMRI scans while performing the Simon Task. This exaggerated use of the frontostriatal circuits is believed to be an adaptive way of gaining more self-control in order to focus and perform repetitive tasks. Information from studies such as this one can be used to help find more effective means of treating tic disorders like TS. (Raz et al., 2009)

There are a few limitations to this study. Patients used in this study may have been medicated for TS thereby obscuring the results of the fMRI scans. Also, not all subjects completed the same amount of sessions of the Simon Task. Researchers wanted all subjects to complete 10 full sessions. All subjects completed at least six sessions. However, it is not clear whether all results that were analyzed were part of the first six that all the subjects completed. If this study were to be repeated, patients agreeing to participate should perhaps be instructed to cease medicating for a few days prior to the day of the study. In addition to this, the researchers should be sure to gather the same amount of tests from all patients as well as use the same tests from all patients, sequentially speaking. (Raz et al., 2009)

Another limitation is that any wrong answers to the Simon Task were excluded from the analysis. In an experiment that is measuring brain activity continuously, it is not clear as to why wrong answers would be excluded. The brain is still working to get the wrong answer. Anything related to the Simon Task which yielded brain activity would seem useable in determining whether or not the hypothesis was correct. Since all brain activity was being recorded, all answers should be used in comparison with each other. At the very least, the wrong answer results should be recorded and discussion should take place in the study as to why they were not used. (Raz et al., 2009)
Another possible down fall could be the imbalanced ratio of males to females across the board. There were a total of 48 males to 33 females. Also, it was not examined as to which sex had more frontostriatal use. This could play a part in the future in determining which drugs could be used for certain patients. If females tended to use more frontostriatal processing and a new drug was developed to target that portion of the brain in easing TS symptoms; it would be wiser and more cost efficient to construct that drug exclusively for women. This would eliminate the need for more research into possible side effects that could affect the sexes differently. Perhaps next time, special attention should be given to how the brain function of women differed from men in addition to the difference between the ages. (Raz et al., 2009)

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