Changes in the Developmental Trajectories of Striatum in Autism

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Background:

Repetitive and stereotyped behavior has been associated with striatum in various neuropsychiatric disorders. However, striatal involvement has not yet been shown conclusively in autism. Issues include the use of neuroleptic medication and differences in mean age between samples, where conflicting results may reflect differences in developmental stage between samples.

Objective:

Therefore, we set out to investigate structural brain *development* in a large and homogeneous sample of high-functioning individuals with autism and controls (n=188). We hypothesized that the caudate nucleus would be enlarged in autism and that its developmental trajectory would differ from that of controls

Methods:

Basal ganglia volumes were assessed on anatomical MRI-scans in 188 individuals (99 subjects with high-functioning autism and 89 typically developing, matched controls) aged between 6 and 25 years.

Striatal structures were traced manually by two experienced raters (DB and ML). To ensure rater blindness to laterality, half of the images were randomly flipped over the y-axis.

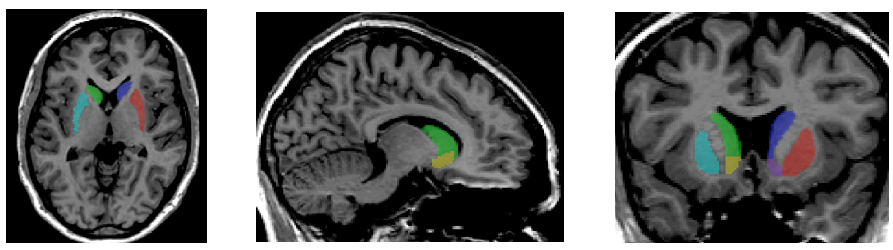

Fig.1 Segmentations of the basal ganglia. Green/blue: caudate nucleus; turquoise/red: putamen; yellow/purple: nucleus accumbens.

Voxel-based morphometry was used to investigate where differences in striatum between diagnostic groups were localized.

To investigate relationships with behavior, correlations were calculated between striatal volumes and three symptom clusters of repetitive behaviors.

Results:

Developmental trajectories of the caudate nucleus, putamen and nucleus accumbens differed between subjects with autism and controls. Results were not accounted for by overall changes in brain volume or neuroleptic medication.

The development of the caudate nucleus differed from typical most, as its volume increased with age in autism ($t=2.06$, $p=0.042$), while it decreased for controls ($t=-3.13$, $p=0.002$).

Voxel-based analysis showed that changes in striatum localized to the head of the caudate nucleus (max $t=4.11$; $p=0.002$).

Overall caudate nucleus volume was associated with repetitive behavior in autism: caudate volume correlated negatively with the 'insistence on sameness' cluster ($r=-0.239$, $p=0.023$)

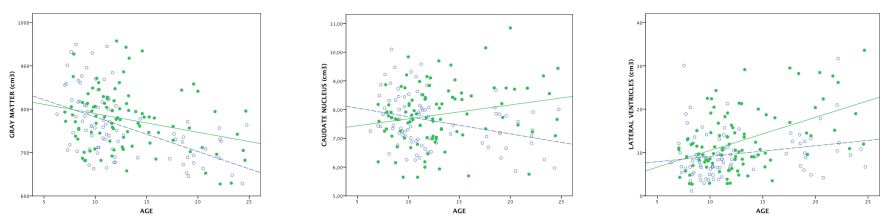

Fig.2 Scatterplots for development of grey matter, caudate nucleus and lateral ventricles for autism (green) and control group (blue).

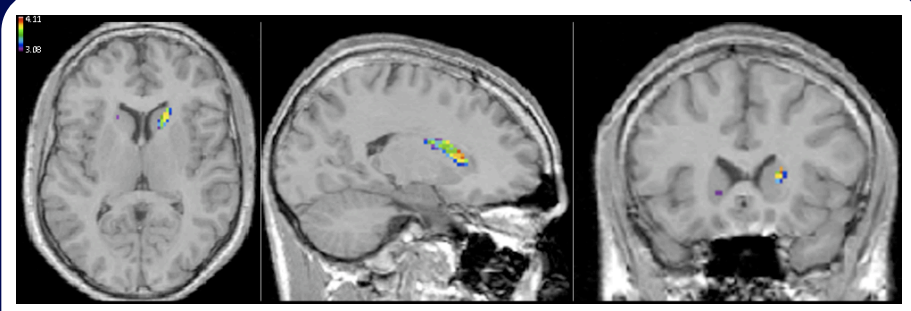

Fig.3 Gray matter density maps of differences between groups. The map is thresholded at the critical t ($t>3.08$).

Conclusions:

We report changes in striatal development in autism, while caudate volume is associated with repetitive behaviors. This emphasizes the importance of striatum in the etiology of autism, in particular in the development of repetitive behavior that characterizes the disorder.