Clinical neuroanatomy

Anomalous brain functional connectivity contributing to poor adaptive behavior in Down syndrome

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ABSTRACT

Research in Down syndrome has substantially progressed in the understanding of the effect of gene overexpression at the molecular level, but there is a paucity of information on the ultimate consequences on overall brain functional organization. We have assessed the brain functional status in Down syndrome using functional connectivity MRI. Resting-state whole-brain connectivity degree maps were generated in 20 Down syndrome individuals and 20 control subjects to identify sites showing anomalous synchrony with other areas. A subsequent region-of-interest mapping served to detail the anomalies and to assess their potential contribution to poor adaptive behavior. Down syndrome individuals showed higher regional connectivity in a ventral brain system involving the amygdala/anterior temporal region and the ventral aspect of both the anterior cingulate and frontal cortices. By contrast, lower functional connectivity was identified in dorsal executive networks involving dorsal prefrontal and anterior cingulate cortices and posterior insula. Both functional connectivity increases and decreases contributed to account for patient scoring on adaptive behavior related to communication skills. The data overall suggest a distinctive functional organization with system-specific anomalies associated with reduced adaptive efficiency. Opposite effects were identified on distinct frontal and anterior temporal structures and relative sparing of posterior brain areas, which is generally

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consistent with Down syndrome cognitive profile. Relevantly, measurable connectivity changes, as a marker of the brain functional anomaly, could have a role in the development of therapeutic strategies addressed to improve the quality of life in Down syndrome individuals.
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