

早期生活逆境对整个童年时期大脑结构和功能 连接耦合的影响

The influence of early-life adversity on the coupling of structural and functional brain connectivity across childhood

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【摘要】 早期生活逆境 (ELA) 暴露被认为可以加速发育。然而, ELA 对神经发育轨迹的影响尚未直接评估, 但很大程度上是根据成人队列的回顾性报告推断的。使用儿科队列研究 (N = 549) 的多模态神经影像数据, 我们利用结构-功能耦合 (SC-FC) (结构和功能连接之间的相关性) 对儿童时期的神经发育轨迹进行建模。从 4.5 岁到 7.5 岁, SC-FC 呈线性下降。当按照 ELA 进行分层时, 只有高逆境组表现出曲线轨迹, 在 4.5 岁至 6 岁之间急剧下降, 表明神经发育加速。这一发现得到了证实, 即在 6 岁时, 与低逆境群体相比, DNA 衍生的表观遗传年龄加速增加。4.5 岁时的 SC-FC 也正向调节 ELA 与童年中期评估的行为结果之间的关联。这些结果证明了 ELA 与神经发育之间的关联, 以及它们如何相互作用以影响行为。

[Abstract] Early-life adversity (ELA) exposure is suggested to accelerate development. However, the influence of ELA on neurodevelopmental trajectories has not been assessed directly but largely inferred from retrospective reporting in adult cohorts. Using multimodal neuroimaging data from a pediatric cohort study (N = 549), we modeled neurodevelopmental trajectories over childhood with structure-function coupling (SC-FC), the correlation between structural and functional connectivity. A linear decrease in SC-FC was observed from age 4.5 to 7.5 years. When stratified by ELA, only

the high-adversity group showed a curvilinear trajectory, with a steep decrease between age 4.5 and 6 years, suggestive of accelerated neurodevelopment. This finding was confirmed by increased DNA-derived epigenetic age acceleration at age 6 years in the high- relative to low-adversity groups. SC-FC at age 4.5 years also positively moderated the associations between ELA and behavioral outcomes assessed in mid-childhood. These results demonstrate the association between ELA and neurodevelopment, and how they interact to influence behavior.

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