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Symposium 01: Neuropsychological Outcomes Following Pediatric Stroke: Research Trends and Advances

9:00 - 10:30am
Thursday, 2nd February, 2023
Pacific Ballroom A

Chair

Claire Champigny
York University, Toronto, Canada

Discussant

Justine Ledochowski
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Summary Abstract:
Stroke is an important cause of acquired brain injury in youth and a significant source of childhood disability. Up to 80% of survivors suffer long-term neurological deficits, including impairments across a range of neuropsychological domains. An improved understanding of neuropsychological outcomes is key to optimizing clinical care, improving evaluation of prognosis, and developing effective rehabilitation and intervention strategies.

The proposed symposium will begin with a literature review on neuropsychological outcomes following pediatric stroke. Next, four studies will be presented, each posing distinct and complementary research questions regarding predictors of outcomes. The roles of both clinical (e.g., lesion size, motor impairment, inflammatory response) and environmental factors (e.g., socioeconomic status, family functioning) will be explored regarding cognitive, social-emotional, and behavioral outcomes. The symposium will end with a Q&A period.

Attendees will leave with an in-depth understanding of recent trends and scientific advances in research on neuropsychological outcomes in pediatric stroke, which should inform clinical practice and research directions. The first presentation examines predictors of neuropsychological outcomes following pediatric stroke. Findings have often conflicted, and more research is needed to disentangle the effects of predictors on specific domains. Explored predictors include: age at stroke; stroke subtype (hemorrhagic vs. ischemic); lesion location; lesion size; time since stroke; neurologic severity; seizure disorder; and socioeconomic status. This study examines the impact of these predictors on distinct neuropsychological domains.

The next presentation addresses associations between neuropsychological outcomes and motor functioning following pediatric stroke. The development of cognitive and motor skills is interrelated and they share common neural substrates. In other populations, motor functioning predicts intellectual ability, and brain connectivity underlies this association. This study investigates associations between motor functioning and global neuropsychological outcomes in children with stroke and explores clinical features associated with motor impairments.

The third presentation explores mental health outcomes. Neuropsychological deficits can hinder academic advancement and social-emotional development and may place youth at increased risk for psychological concerns. An increased focus on mental health is warranted given that psychosocial and behavioral issues are often the most concerning problems for parents and teachers. This study uses a qualitative paradigm to shed light on lived experience of youth with stroke with a focus on mental health, relationships, and social competence.

The fourth presentation consists of a systematic review exploring the association between inflammatory response and neuropsychological outcome. Stroke induces an inflammation in the central and peripheral nervous systems, and high levels of inflammatory markers following stroke have been associated with poorer cognitive outcomes. This study reviews the state

of research on this topic with a focus on pro-inflammatory cytokines and c-reactive protein. The symposium topics covered lie at the heart of the INS mission to study brain-behavior relationships using a multidisciplinary lens, with an emphasis on sharing and applying scientific knowledge. The symposium seeks to inform professionals working with youth with stroke about cutting-edge research, clinically applicable and novel insights, and ideas for future research directions. In this way, our symposium contributes to evidence-based care and the advancement of research.

Keyword 1: pediatric neuropsychology
Keyword 2: stroke
Keyword 3: cognitive functioning

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1 Predictors of Neurocognitive Outcome in Pediatric Ischemic and Hemorrhagic Stroke

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Objective: Neurocognitive deficits commonly occur following pediatric stroke and can impact many neuropsychological domains. Despite awareness of these deleterious effects, neurocognitive outcome after pediatric stroke, especially hemorrhagic stroke, is understudied. This clinical study aimed to elucidate the impact of eight factors identified in the scientific literature as possible predictors of neurocognitive outcome following pediatric stroke: age at stroke, stroke type (i.e., ischemic vs. hemorrhagic), lesion size, lesion location (i.e., brain region, structures impacted, and laterality), time since stroke, neurologic severity, seizures post-stroke, and socioeconomic status.
Participants and Methods: Ninety-two patients, ages six to 25 and with a history of pediatric stroke, chose to participate in the study and were administered standardized neuropsychological tests assessing verbal reasoning, abstract reasoning, working memory, processing speed, attention, learning ability, long-term memory, and visuomotor integration. A standardized parent questionnaire provided an estimate of executive functioning.
Statistical analyses included spline regressions to examine the impact of age at stroke and lesion size, further divided by stroke type; a series of one-way analysis of variance to examine differences in variables with three levels; Welch's t-tests to examine dichotomous variables; and simple linear regressions for continuous variables.
Results: Lesion size, stroke type, age at stroke, and socioeconomic status were identified as predictors of neurocognitive outcome in our sample. Large lesions were associated with worse neurocognitive outcomes compared to small to medium lesions across neurocognitive domains. Exploratory spline regressions suggested that ischemic stroke was associated with worse neurocognitive outcomes than hemorrhagic stroke. Based on patterns shown in graphs, age at stroke appeared to have an impact on outcome depending on the neurocognitive domain and stroke type, with U-shaped trends suggesting worse outcome across most domains when stroke occurred at approximately 5 to 10 years of age. Socioeconomic status positively predicted outcomes across most neurocognitive domains. Participants with seizures had more severe executive functioning impairments than youth without seizures. Youth with combined cortical-subcortical lesions scored lower on abstract reasoning than youth with cortical and youth with subcortical lesions, and lower on attention than youth with cortical lesions. Neurologic severity predicted scores on abstract reasoning, attention, processing speed, and visuomotor integration, depending on stroke type. There was no evidence of differences on outcome measures based on time since stroke, lesion laterality, or lesion region defined as supra- versus infratentorial.
Conclusions: The current study contributed to the scientific literature by identifying lesion size, stroke type, age at stroke, and socioeconomic status as predictors of neurocognitive outcome following pediatric stroke. Future research should examine other possible predictors of neurocognitive outcome that remain unexplored. Multisite collaborations would provide larger sample sizes and allow teams to build models with better statistical power and more predictors. Enhancing understanding of neurocognitive outcomes following pediatric stroke is a first step towards improving appraisals of prognosis.