Neurocognitive and behavioural outcomes of stroke in children

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Stroke in Children

- Arterial Ischemic Stroke (AIS)
  - Focus of most research pediatric research
- Hemorrhagic Stoke (HS)
  - Limited research especially on cognitive outcomes in pediatric patients

General Outcomes

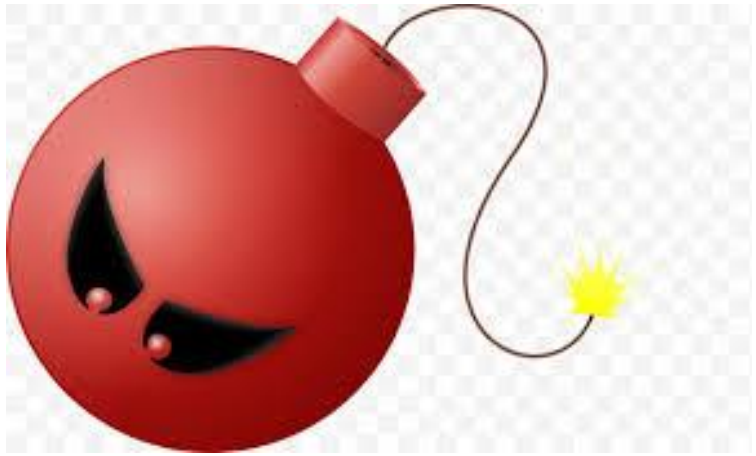
- Significantly lowers quality of life across physical, emotional, school, social and cognitive functioning
  - Despite plasticity 70-80% suffer long term disabilities
- Research indicates few domains of cognitive functioning are unaffected following childhood stroke
  - Difficulties more obvious typically immediately after stroke and for some improvement may occur thereafter

General Outcomes

- Seizures are common in acute phase
- Cognitive and behavioural challenges
- Research shows worse outcomes in AIS compared to HS children

Behavioural outcomes

- Difficulties with behavior and emotion regulation
  - Temper tantrums
  - Anger outbursts
  - Emotional lability



Comorbid diagnoses

- Epilepsy
- ADHD (inattentive)
- Limited research on psychiatric diagnoses
  - For instance Max et al (2002)
    - In the absence of SES, race, gender, family history
    - Anxiety disorders
    - Mood disorders
  - Those with PD significantly lower adaptive functioning

General Neurocognitive outcomes

- Significant varying cognitive impairments irrespective of lesion location
  - Impairment is selective in some cases (EF impairments with average IQ) and may therefore be missed
- Larger lesions associated with greater dysfunction

General Neurocognitive outcomes 2

- Cognitive functioning in children following stroke do not indicate lateralization or location of the lesions
- For instance, LH strokes may not present with severe language difficulties
  - Compensation in developing networks in children compared to adults - specifically language
    - The may come at the expense of visuospatial RH functioning
- Age onset may have determining factor

Age of onset

- Controversial findings
  - Some studies found younger age = poorer outcomes with more severe neurological outcome
  - Others studies found later age = negative outcomes
  - Similar mixed results on longitudinal studies
    - Stable FSIQ as children aged
    - Average at pre-school age but decline over time to low average indicating slow rate of cognitive development

Age onset 2

- Task/function dependent
  - Early onset group poor on all tasks (<12months)
  - Late onset group larger differences on two specific EF tasks (<12 months)
  - <1 years and > 6 years both performed poorly on tasks suggesting nonlinear effect
- Methodological issues complicate findings

Neurocognitive outcomes

- Inconsistent results:
  - Mild – moderate changes in IQ scores ranging from average to slightly below average to poor overall FSIQ
    - PIQ generally worse than VIQ independent of the hemisphere involved
    - PIQ impacted by motor problems
    - Better recovery of VIQ over PIQ

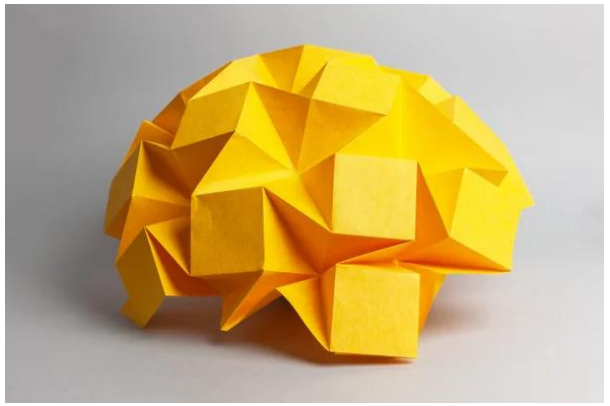
Neurocognitive outcomes 2

- Early language difficulties
  - Depending on age of stroke
- Range of attentional problems (mild-severe)
  - Sustained and divided attention
  - Decreased accuracy and variability in reactic
- Reduced working memory

Neurocognitive Outcomes 3

- Slower processing speed
  - Possibly impacted by motor problems
- Problems with cognitive flexibility and set shifting
- Impulsivity

HS Neurocognitive outcomes



- Limited research in children
  - IQ functioning similar to AIS
    - Ex: Dutch study - average FSIQ however signs of deficits compared to pre-morbid functioning
    - Case series found range of cognitive deficits – none to severe
  - No relationship between age onset or location

MoyaMoya

- General neurocognitive difficulties
  - Range of IQ
    - Progression of disease leads to decreasing IQ scores
  - Slow processing speed
  - Executive function problems
    - Attention
    - Impulsivity
- Bilateral vasculopathy and strokes = worse outcomes

MoyaMoya RXH cases

- 6 cases of multifocal infarct

  MoyaMoya disease

  - 1 patient couldn't be assessed given behavioural and mood difficulties – she refused most tasks

    - Impulsive, obstinate, distractible, socially inappropriate

- Various cognitive difficulties

	FSIQ	VIQ	PIQ	Attention	Processing Speed	Fine Motor
Patient 1	Extremely low	Extremely low	Borderline	Extremely low	Low average	NA
Patient 2	Borderline	Average	Borderline	Extremely low	NA	NA
Patient 3	Extremely low	Extremely low	Extremely low	Borderline	Extremely Low	NA
Patient 4	Extremely low	Extremely low	Extremely low	Poor	NA	Poor
Patient 5	Borderline	Extremely low	Low average	Borderline	NA	Borderline

MoyaMoya RXH cases

- Language problems in two patients
  - Poor naming, reading and low average comprehension
- Difficulties with problem solving and set shifting in one patient and frustration tolerance and planning in another patient

Reassessment 2 children

- No decline in attention – still borderline
- Still fine motor problems
- IQ remained stable
  - Some improvement in Vocab (ex low to borderline)
  - FSIQ still borderline and PIQ low average
- No evidence of decline – some improvement in self-monitoring and vocabulary

- Attention still poor
- Comprehension no age appropriate improvement – lower score (ex low vs low average)
- Poor fine motor – not assessed previously
- IQ remained stable
  - Still ex low in all domains
  - Even though ex low some improvement in verbal ability
- No evidence of decline

- Ballantyne, Spilkin, Hesselink, & Trauner, 2008
- Anderson et al., 2009, 2010
- Ganesan et al., 2000
- Cnossen et al., 2010
- Long, Anderson, et al., 2011
- Long, Spencer-Smith, et al., 2011
- Max, Bruce, Keatley, and Delis, 2010
- Pavlovic et al., 2006
- Westmacott et al., 2009
- Steinlin et al., 2004
- Williams et al., 2012
- Everts et al., 2008
- Westmacott et al., 2009
- Jordan 2007