Comprehensive assessment of executive functioning following severe childhood traumatic brain injury: Validation of the newly developed French FEE battery

Mathilde Chevignard 1,2,6, Lucie Salah 1,2, Emmanuelle Pineau-Chardon 1, Jeanne Roche 1,2, Caroline Huon 1, Didier Le Gall 5, Marie Er-Rafiqi 5, Nathalie Fournet 6, Jean-Luc Roulin 6 & Arnaud Roy 5,7

1 Pediatric resident Paris university; 2 Rehabilitation Department for children with acquired neurological injury, Saint Maurice Hospitals, Saint Maurice; 3 Sorbonne Université, Laboratoire d’Imagerie Biomédicale, LIB, 75006 Paris; 4 GRC24 Handicap Moteur et Cognitif et Réadaptation (HaMCRe) – Sorbonne Université, Paris; 5 Laboratory of Psychology of Pays de la Loire, EA4638, Angers, University; 6 Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, LPRC, 38000 Grenoble; 7 Neurofibromatosis Clinic and Learning Disabilities Reference Center, Nantes University Hospital; 8 SMAEC, Lyon; 9 Laboratory of Psychology of Capucins, Angers; France.

Executive functions

- A collection of related but distinct abilities that allow individuals:
  - To engage efficiently and effectively in intentional, complex, purposeful goal-directed problem-solving actions
  - Through conscious and effortful processing
  - Allow one to adapt to novel situations, especially when action routines and over-learned sequences are not sufficient.

- EF deficits extremely frequent following childhood TBI
  - Significant impact on everyday functioning and independence

- Assessment (and rehabilitation) challenging
  - Lack of sufficiently standardised developmentally appropriate comprehensive assessments of executive functions

Severe childhood TBI

- Leading cause of death and acquired disability
  - Serious public health issue

- Multiple impairments
  - Sensory motor functioning
  - Cognitive, behavioural, emotional, and social functioning deficits

Aims of the study

- To perform a detailed description of executive functioning following moderate-to-severe childhood TBI,

- To study demographic and severity factors influencing outcome,

- Using a newly developed test battery (Childhood Executive Functions – FEE Battery; Roy et al.), based on Diamond’s developmental model of EFs
Participants

- 43 patients with moderate/severe TBI (7-16 years; 65% boys)
  - Referred to a rehabilitation department
  - No previous diagnosis of neuro/psy/learning disability
  - Mean age at injury 9.12 years (SD=4.1),
  - Time since injury 1.02 (SD=2.67).
  - 39 (93%) severe TBI
    - Mean length of coma 6 days (SD=11.21)
- 86 matched controls (age, gender, parental education)
  - Estimated intellectual ability significantly higher in control group
    - WISC IV vocabulary [11.7 (2.6) vs. 8.9 (3.8)], matrices [10.2 (2.9) vs. 7.9 (3.5)] p<0.001

Results

FEE battery
Inhibition

- All 3 subtests Cancel Joe, Stroop & Tapping.
- Largest effect size: Cancel Joe (imprecision) & Tapping (time C-A).

Methods – Outcome measures

4 EF domains; predominant involvement of language or VS skills
Standardization underway, almost 1000 Healthy participants 7-16 years
Outcomes: time, errors, achievement

Results

FEE battery
Flexibility

- All 3 subtests: Brixton, TMT & NCST (except rule abandonment)
- Largest effect size: Brixton (time) & NCST (time and perseveration).
Results

FEE battery

Working Memory

- Mixed results
- Significant differences for visual-spatial updating task
- No difference for verbal updating task or dual task

Planning

- Mixed results
- Labyrinths (time & number of completed labyrinths), moderate effect size
- Rey Figure copy: NS
- Scripts: analyses underway...

Results BRIEF

Parent-ratings

Teacher-ratings

Factors influencing outcome

- Univariate correlations in the TBI group did not yield significant correlations
  - between FEE subtests or BRIEF questionnaires
  - and socio-economic status, TBI severity, or age at injury
Conclusion

• Significant impairment in TBI group, in most FEE subtests
  • All time measures & most error measures
  • Moderate to large effect sizes
• Regarding everyday life, impairment in most BRIEF subscales
  • Worse for teacher than parent reports
• No clear factor influencing outcome in this sample

• Similar study in patients with brain tumours (Roche et al. see poster)
  • Very different EF profile

Thank you for your attention