ESTABLISHING A COMPUTERIZED TOOL FOR CLINICAL EVALUATION OF COGNITIVE FUNCTION IN CHILDREN WITH NEW-ONSET EPILEPSY

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INTRODUCTION

- Children with epilepsy are at risk for compromised cognitive outcomes.
- Traditional neuropsychological testing is time-consuming and costly to perform longitudinally.
- We investigated the ability of a computerized cognitive testing battery to detect differences before and after medication initiation.

METHODS

Patients

- Recruited from outpatient neurology clinic at the Children's Hospital of Pittsburgh
- Aged 8-17 years with a new epilepsy diagnosis
- Epilepsy medication-naïve at time of enrollment
- No history of developmental delay
- English as a first language
- Age-appropriate reading and computer skills

Behavioral Assessments

Parents or guardians completed:

- Strengths and Difficulties Questionnaire (SDQ)
- Hague Side Effects Scale (HASES)

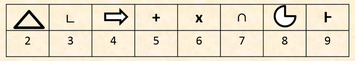
Cognitive Testing

- CNS Vital Signs
  - 30 minute computerized battery
  - 7 tasks:
    - Verbal Memory Test (VBM)
    - Visual Memory Test (VIM)
    - Finger Tapping Test (FTT)
    - Symbol Digit Coding Test (SDC)
    - Stroop Test (ST)
    - Shifting Attention Test (SAT)
    - Continuous Performance Test (CPT)

Domain Score	Composite Tests
Neurocognition Index	VBM, VIM, FTT, SDC, ST, SAT, CPT
Composite Memory	VBM, VIM
Verbal Memory	VBM
Visual Memory	VIM
Psychomotor Speed	FTT, SDC
Reaction Time	ST
Processing Speed	SDC
Cognitive Flexibility	SAT, ST
Complex Attention	CPT, SAT, ST
Executive Function	SAT

- Baseline testing completed before anticonvulsant therapy initiation
- Follow-up testing completed 2-12 months following baseline testing

Symbol Digit Coding Test



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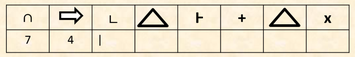
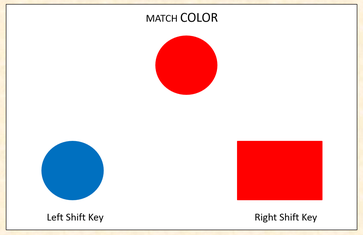


Shifting Attention Test



RESULTS

Patient Characteristics

Total enrolled (N = 29)

Mean age (SD)	Gender		Seizure type		Lifetime seizure total	
12.5 (2.2)	Male	15	Partial	6	< 5	18
	Female	14	Generalized	23	5 – 10	2
					> 10	9

Total follow-up sessions completed (n = 14)
Mean time to follow-up: 4 months

Mean age (SD)	Gender		Seizure type		AED		Lifetime seizure total	
12.1 (1.8)	Male	8	Partial	2	LEV	8	< 5	9
	Female	6	Generalized	12	OXC	2	5 – 10	2
					LTG	2	> 10	3
					VPA	1		
					ZNS	1		
					TPM	1		
					KLON	1		

Cognitive Testing

Baseline Domain Scores (N = 29)

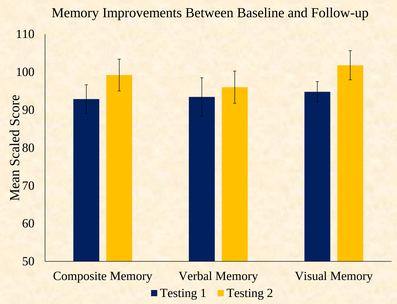
	Mean	SD
Neurocognition Index	89.1	16.2
Composite Memory	93.1	17.8
Verbal Memory	95.2	19.9
Visual Memory	93.8	13.6
Psychomotor Speed	89.9	18.4
Reaction Time	89.9	20.8
Processing Speed	94.1	16.3
Cognitive Flexibility	89	19.8
Complex Attention	83.7	29.8
Executive Function	90.9	18.1

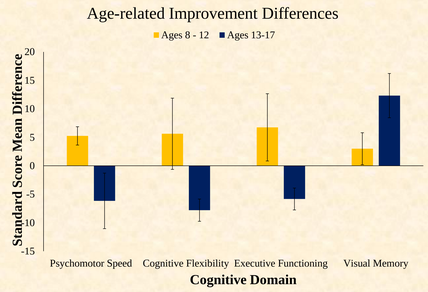
CNS VS raw scores are normalized and standardized to scores from age-matched controls (ages 8 – 90). Scaled scores have a mean = 100, standard deviation = 15.

Follow-up Domain Scores (n = 14)

	Baseline		Follow-up			
	Mean	SD	Mean	SD	t-score	p-value (2-tailed)
Neurocognition Index	89.8	14.5	88	21.5	0.42	0.68
Composite Memory	92.9	14.1	99.2	15.7	**-2.43**	**0.03***
Verbal Memory	93.4	18.9	96	15.9	-0.71	0.49
Visual Memory	94.8	10	101.8	14.4	**-2.73**	**0.02***
Psychomotor Speed	89.1	17.1	89.4	13.8	-0.13	0.9
Reaction Time	86.4	20.3	86.7	21	-0.05	0.96
Processing Speed	92.7	15.4	90.9	13	0.34	0.74
Cognitive Flexibility	92.2	15.8	91.9	16.9	0.09	0.93
Complex Attention	89.1	18.2	67.4	72.8	1.28	0.23
Executive Function	93.6	15.4	95	16.4	-0.36	0.73

Patients demonstrated significant improvements in composite memory and visual memory at the time of follow-up testing.





At follow-up, children aged 8 – 12 years (n = 8) had increased scores while children aged 13 – 17 (n = 6) had decreased scores* in:

- psychomotor speed
- cognitive flexibility
- executive functioning

Children ages 13 – 17 increased their visual memory scores more than children ages 8 – 12.*

* Non-significant trends, all two-sample, unequal variance t-tests yielded two-tailed p-values < 0.085.

Acknowledgement: We thank CNSVS for providing us with technical support and equipment

RESULTS

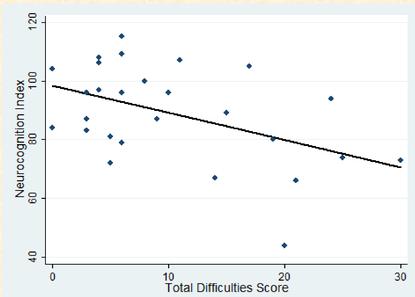
Behavioral Assessments

Strengths and Difficulties Questionnaire

- At baseline, mean scores were within normal ranges.
- Paired comparisons did not show significant changes at follow-up testing.

	Total Difficulties	Emotional Symptoms	Conduct Problems	Hyperactivity	Peer Problems	Prosocial Behavior
Mean (SD)	10.0 (8.1)	3.0 (2.8)	1.6 (2.1)	3.8 (2.8)	1.7 (1.9)	8.8 (1.8)
Normal Range	0-13	0 – 3	0 – 2	0 – 5	0-3	6-10

Lower Neurocognition Index scores at baseline were associated with higher Total Difficulties scores.



Hague Side Effects Scale

- Most parents reported that their children had only mild or no problems since starting medication.
- Very few parents noted that their children had very serious problems at time of follow-up.
- The most commonly reported issues were:
  - having the "blues"
  - tantrums or aggression
  - school problems
  - difficulty concentrating
- No clear relationships between HASES scores and changes in cognitive performance.

SUMMARY & CONCLUSIONS

Feasibility of Computerized Cognitive Testing:

- Computerized cognitive testing was well-tolerated and easily performed in our sample of children with new-onset epilepsy in the clinic setting.

Clinical Significance:

- Children with epilepsy significantly improved their scores on the visual memory domain at the time of follow-up testing.
  - CNS VS may be able to detect cognitive improvements associated with initiation of anti-epileptic medications.
- Baseline cognitive impairments were associated with parent reports of greater behavioral problems.
  - Cognitive testing may be relevant to real-world difficulties.

Serial screening using computerized cognitive testing may offer a rapid and efficient method to quantify changes associated with anti-epilepsy therapy.

Bibliography

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