The Effect of Therapeutic Hypothermia on Neurocognitive Function in Survivors of Cardiac Arrest

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BACKGROUND

- The advent of Therapeutic Hypothermia (TH) has led to an increase in post-cardiac arrest (CA) survival, yet often neurologic recovery is variable.[1]
- Few studies have quantitatively evaluated CA survivors treated with TH for long-term neurocognitive deficits compared to patients post-CA who did not receive TH.

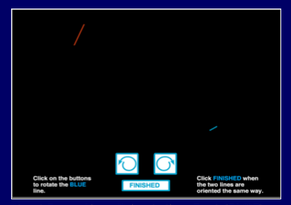
OBJECTIVES

We sought to assess the feasibility of using a computer-based neurocognitive battery in determining neurological outcomes for post-CA survivors. We hypothesized that survivors who underwent TH would exhibit better neurocognitive performance than those who had not undergone TH.

METHODS

- A validated internet-based neuropsychological battery, "WebCNP"[2], was administered to post-CA survivors to evaluate neurologic function in cognitive domains including but not limited to Sensory Motor, Emotion Recognition, and Spatial Orientation.
- Certified WebCNP personnel administered a pre-study survey and the computerized test battery in the homes of post-CA survivors.

Penn Conditional Exclusion Task (PCET)
Cognitive Domain Tested – Abstraction and Mental Flexibility (Executive Function)



Short Penn Line Orientation Test (PLOT)
Cognitive Domain Tested – Spatial Orientation

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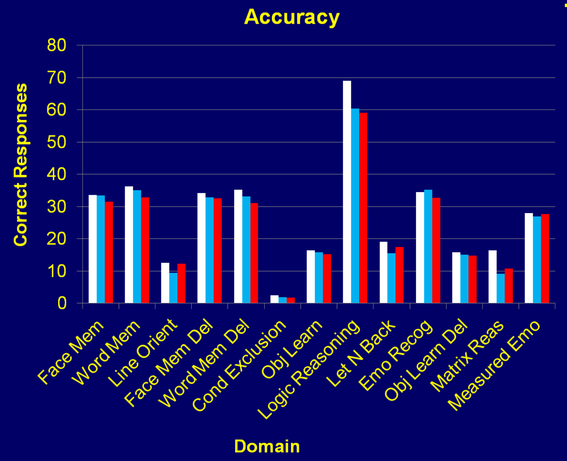
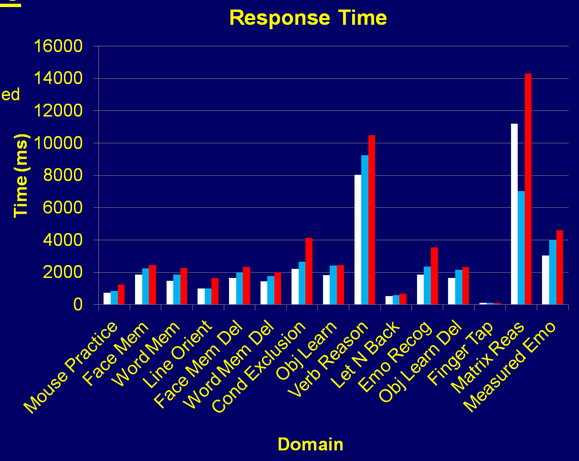
RESULTS





Demographics

n=25	
Mean length of time from CA to testing date	1.2 ± 0.3yrs (range xxx-xxx)
Age (all subjects)	53.1 ± 8.7yrs
Age (cooled)	49.8 ± 8.4yrs
Age (non-cooled)	55.2 ± 9.1yrs
Female	7 (28%)
Initial rhythm VF/VT	16 (68%)
TH applied	10 (40%)

Statistically Significant Domains

Arrest vs. Healthy Control

Domain Tested	Measure Type	Measure	Z-score*
Sensory Motor	Response Time	Median Response Time for Motor Praxis Trial 2 Correct Responses	-2.613
Word Memory	Response Time	CPW Median Response Time for Correct Responses	-2.133
Emotion Recognition	Response Time	ER40 Median Response Time for Correct Responses	-2.707
Visual Attention and Vigilance	Accuracy	Sensitivity Across All Trials (% Correct per targets)	-2.104

*z-scores were used when comparing results against validated norms because only the average score values were available. A P-value was used when comparing cooled vs. non-cooled subjects.

TH vs. Non-TH treated

Domain Tested	Measure Type	Measure	P-value
Abstraction and Mental Flexibility (Executive Function)	Response Time	Median Response Time for Correct Responses	0.032
Spatial Orientation	Response Time	Median Response Time Per Expected Number of Clicks for Ideal Solution	0.013
Emotion Recognition	Response Time	Median Response Time for Correct Responses	0.044
Abstraction and Mental Flexibility	Response Time	Median Response Time for Correct Responses	0.045
Emotion Recognition	Accuracy	Number of Correct Responses	0.030
Delayed Word Memory	Accuracy	Number of Correct Responses	0.038

Overall Post-CA Population

- Accuracy scores were lower in the overall post-CA cohort than healthy controls on 13/13 accuracy tests
- Slower response times were noted on 14/15 response time tests in the post-CA cohort than healthy controls

TH-treated Subjects

- Accuracy scores were higher on 9/13 tests among TH treated than non-TH treated subjects
- Faster response times were noted on 13/15 response time tests among TH treated than non-TH treated subjects

CONCLUSIONS

- CA survivors exhibited deficits in specific domains of cognitive function compared to a previously validated healthy cohort.
- Non-TH subjects demonstrated slower response times and lower accuracy scores than TH-treated counterparts
- This study demonstrates the potential value of quantitative evaluation of neurocognitive outcomes for future post-CA clinical studies.

REFERENCES

1. R.C. Gur et al, Computerized neurocognitive scanning, Neuropsychopharmacology 2001;25(5):xxx-xxx.
2. F.J. Mateen et al, Long-term cognitive outcomes following out-of-hospital cardiac arrest, Neurology, October 11, 2011