

Endothelial Function and Verbal Memory Performance in Patients With Coronary Artery Disease Undertaking Cardiac Rehabilitation

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Introduction

- Early identification of potentially modifiable risk factors for vascular cognitive impairment (VCI) is important for effective preventive strategies
- Coronary artery disease (CAD) patients are at increased risk of VCI and dementia¹
- Endothelial dysfunction, a common feature of CAD, may be a risk factor for VCI² that may be modified by exercise³
- The association between endothelial function and changes in cognition following exercise in those at risk of VCI remains unclear

Study Objective

- To assess the relationship between changes in endothelial function and changes in cognition in CAD patients undergoing cardiac rehabilitation (CR)

Methods

Inclusion Criteria

- Diagnosis of CAD
- 50-75 years old
- Speaks and understands English
- Stable CAD based on no recent hospitalization for cardiac events
- Taking a statin medication

Exclusion Criteria

- Significant cognitive impairment (MMSE < 24) or dementia
- Significant acute medical illness
- Diagnosis of schizophrenia or bipolar disorder

Study Design:

- Cognition was measured at entry into a 6-month CR program and at program termination
 - Verbal memory: California Verbal Learning Test (CVLT) 2nd edition by combining Z-scores from immediate recall, short-delay free recall and long-delay free recall outcomes
 - Executive function : Trail Making Test (TMT) A & B and the Controlled Oral Word Association Test (COWAT) by combining Z-scores from all tests
- Endothelial function was measured by reactive hyperemia index (RHI) via peripheral arterial tonometry
- Analysis of variance (ANOVA) was used to assess differences in cognitive changes between CAD patients whose endothelial function improved and those whose endothelial function worsened during CR

Results

Table 1 Patient sociodemographic and clinical data at baseline (n=32)

	Endothelial Function Improved (n=19)	Endothelial Function Worsened (n=13)	p-value (significance p<0.05)*
	Mean ± SD or n (%)	Mean ± SD or n (%)	
Sociodemographics			
Age (years)	66 ± 6	66 ± 8	0.99
Gender (# of males)	16 (84)	12 (92)	0.51
Total Education (years)	17 ± 4	16 ± 4	0.84
Ethnicity (# of Caucasians)	15 (79)	12 (92)	0.29
Cardiac Risk Factors			
Weight (kg)	86 ± 17	88 ± 19	0.79
BMI (kg/m ²)	29.5 ± 5.4	28.8 ± 5.1	0.72
Total Cholesterol (mmol/L)	3.4 ± 1.0	3.2 ± 0.5	0.68
Smoking History	14 (74)	6 (46)	0.12
Systolic BP (mmHg)	131 ± 28	122 ± 14	0.30
Diastolic BP (mmHg)	77 ± 11	76 ± 11	0.93
Hypertension	19 (100)	12 (92)	0.34
Diabetes	3 (16)	2 (15)	0.98
Cardiac History			
MI	10 (53)	5 (39)	0.45
CABG	4 (21)	7 (54)	0.07
Stent	12 (63)	7 (54)	0.61
Cardiorespiratory Fitness			
VO ₂ Peak (mL/kg/min)	19.1 ± 5.9	20.8 ± 6.4	0.47
Max Heart Rate (bpm)	120.2 ± 20.9	122.7 ± 19.6	0.74
Concomitant Medications			
β-blockers	14 (74)	12 (92)	0.16
Anti-hypertensives	15 (79)	7 (54)	0.16
Platelet Inhibitors	19 (100)	12 (92)	0.34
Diuretics	2 (11)	2 (15)	0.70
Cognitive Performance			
Composite Verbal Memory Performance Z-score	1.6 ± 2.5	3.2 ± 3.1	0.10
Composite Executive Function Z-score	-1.0 ± 1.6	0.5 ± 2.6	0.08
Endothelial Function			
RHI	1.6 ± 0.2	2.1 ± 0.6	< 0.01*

Abbreviations: BMI = body mass index; LDL = low-density lipoprotein; HDL = high-density lipoprotein; BP = blood pressure; MI = myocardial infarction; CABG = coronary artery bypass graft surgery; RHI = reactive hyperemia index.

- Neither verbal memory performance nor executive function at baseline were significantly different between the two groups [Table 1]
- Change in verbal memory performance over the course of CR was significantly greater in those whose endothelial function improved compared to those whose endothelial function worsened (F=4.5; p=0.04) after controlling for age and VO₂ Peak [Figure 1]
- Change in executive function over the course of CR was not significantly different between the two groups (F=0.4; p=0.55) after controlling for age and VO₂ Peak

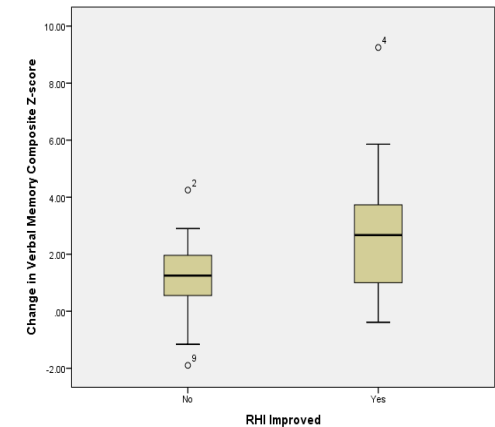


Figure 1 Differences in change in verbal memory composite Z-score over the course of CR between those whose endothelial function improved and those whose endothelial function worsened

Conclusions/Significance

- Previous studies have been unable to link cognitive improvements following exercise with improvements in cardiovascular fitness
- In this small study, improved endothelial function over CR was associated with greater improvements in verbal memory but not executive function
- Improved endothelial function may be one mechanism by which exercise contributes to preservation of cognitive function in those at risk of VCI and should be further investigated

References

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