

# Decreased cardiovascular function late after coarctation repair



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**INTRODUCTION** Survival after repair of a coarctation of the aorta (CoA) is good but in adulthood late residua including hypertension, restenosis and heart failure are not uncommon. The timing and the mechanism behind this long term sequelae are not fully understood. This study aims to evaluate cardiac function, cardiac autonomic nervous system (ANS) activity, exercise capacity and physical activity in children late after CoA repair.

**METHODS** 32 patients (19 boys) after CoA repair and 61 healthy age- and sex-matched controls underwent detailed echocardiography (measurement of longitudinal left ventricular strain and biventricular Tissue Doppler Imaging (TDI)), cardiopulmonary exercise testing (measurement of breath-by-breath oxygen consumption) and 24h monitoring of cardiac ANS activity and cardiac output (CO) (measurement of electrocardiogram and impedance cardiography). Parasympathetic activity was measured by respiratory sinus arrhythmia (RSA) and sympathetic activity was by the pre ejection period (PEP). Heart rate, PEP, RSA and CO were aggregated for five different conditions during the day (sleep, quiet/active sitting, moderate/heavy physical activity (PA)). Weekly physical activity including physical education at school, regular biking/walking behavior and sports participation was mapped using a questionnaire.

		CoA patients	Healthy controls
VO <sub>2peak</sub> (ml/kg/min)*		40.8 (9.6)	45.0 (7.3)
Physical activity (METs/week)		39.3 (21.3)	49.5 (23.6)
LV longitudinal strain (%)		16 (2)	17 (3)
LV peak systolic wave velocity (cm/s) *		0.09 (0.03)	0.11 (0.03)
LV peak early wave velocity (cm/s) *		0.15 (0.05)	0.19 (0.04)
Septal peak early wave velocity (cm/s) *		0.13 (0.02)	0.14 (0.02)
Heart rate (bpm)	Sleep	67 (8)	65 (9)
	Quiet sitting	79 (9)	80 (13)
	Active sitting	83 (9)	85 (11)
	Moderate PA	105 (12)	110 (15)
	Heavy PA	124 (16)	128 (16)
RSA (ms)	Sleep	113 (52)	119 (57)
	Quiet sitting	93 (56)	93 (46)
	Active sitting	88 (30)	81 (36)
	Moderate PA	42 (21)	35 (14)
	Heavy PA	29 (14)	24 (11)
PEP (ms)	Sleep	95 (20)	98 (14)
	Quiet sitting	93 (19)	92 (13)
	Active sitting	95 (19)	95 (15)
	Moderate PA	82 (17)	76 (14)
	Heavy PA	72 (11)	66 (8)
CO (L/min)	Sleep	3.2 (1.0)	3.7 (1.0)
	Quiet sitting	3.5 (1.1)	4.0 (1.2)
	Active sitting	3.5 (1.0)	4.2 (1.3)
	Moderate PA*	4.0 (1.3)	4.9 (1.6)
	Heavy PA*	4.0 (1.2)	4.8 (1.7)



**RESULTS** Age of the patients and controls ranged from 8-18y (mean 13.3±2.9). Patients were operated at a median age of 0.4 year old (range 3 days – 5.8 years) and time after intervention was on average 10y.

Left ventricular **longitudinal strain** was not different in patients compared to controls (p=0.52). TDI revealed decreased left ventricular diastolic and systolic function compared to controls. Additionally, septal peak early wave velocity was lower in patients compared to controls.

Analysis of 24h monitoring of cardiac **ANS** revealed no differences between groups; heart rate, PEP and RSA were not different between groups during various activities during the day (see table). **CO** was lower in patients during physical activities.

Maximal oxygen uptake (**VO<sub>2peak</sub>**) was lower in patients compared to controls p=0.01). **Maximal heart rate** was not different (p=0.93). Diastolic **blood pressure** was higher at maximal exercise in patients (68.4±14.7 mmHg) compared to controls (58.8±15.9 mmHg, p=0.006).

There was no difference in **weekly physical activity** between patients and controls (p=0.09).

**CONCLUSION** This study shows that in childhood, 10 years after correction of a CoA:

- Cardiac LV function and exercise capacity are already decreased.
- Cardiac ANS activity was not different from controls.
- Decreased exercise capacity could not be explained by a lower weekly physical activity in patients.

\*difference between groups p<0.01