6-2022

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INTRODUCTION

Global myocardial work index (GWI) obtained by non-invasive pressure-strain loops is a fast-emerging tool to assess myocardial contractility, independent of loading conditions. Data about the feasibility and utility of this modality in single ventricles are still lacking.

AIM

We aimed to explore the relationship between the non-invasive myocardial work indices and exercise parameters in the Fontan population.

METHOD

Fontan patients were prospectively evaluated by exercise testing and echocardiography.

- The systemic ventricle was tracked in 3 orthogonal apical planes for global longitudinal strain (GLS).

- Pressure-strain loops were generated against brachial blood pressure (surrogate for ventricular systolic pressure in the absence of outflow obstruction).

- GWI, global work efficiency (GWE), global constructive work (GCW) and global wasted work (GWW) were calculated.

- Peak VO2 and percentage of predicted peak VO2 were recorded during the same visit.

RESULTS

Seventeen Fontan patients were included, 10 (58%) of whom had systemic left ventricle. Mean age was 13.8 y (range 9-21 y). Peak VO2 was 24.7 ± 5.9 ml/kg/min and predicted VO2% was 57.4 ± 11.1%. GLS was -14% ± 2.5%.

- Mean **GWI** was 979.9 ± 232 mmHg% which showed a strong correlation with the **predicted VO2% (r=0.78, p<0.001).**

- Similarly, there was a strong correlation between **GWE** (mean= 87 ± 4.8%) and **predicted VO2% (r=0.76, p=0.001).**

- Less correlation was found between GLS and predicted VO2% (r=-0.58, p=0.019).

- GCW was 1293 ± 399 mmHg% and GWW was 161.1 ± 88 mmHg%. GWW had a moderate negative correlation with peak VO2 and predicted VO2% (r= -0.45, p=0.07 and r=-0.48, p= 0.06 respectively).
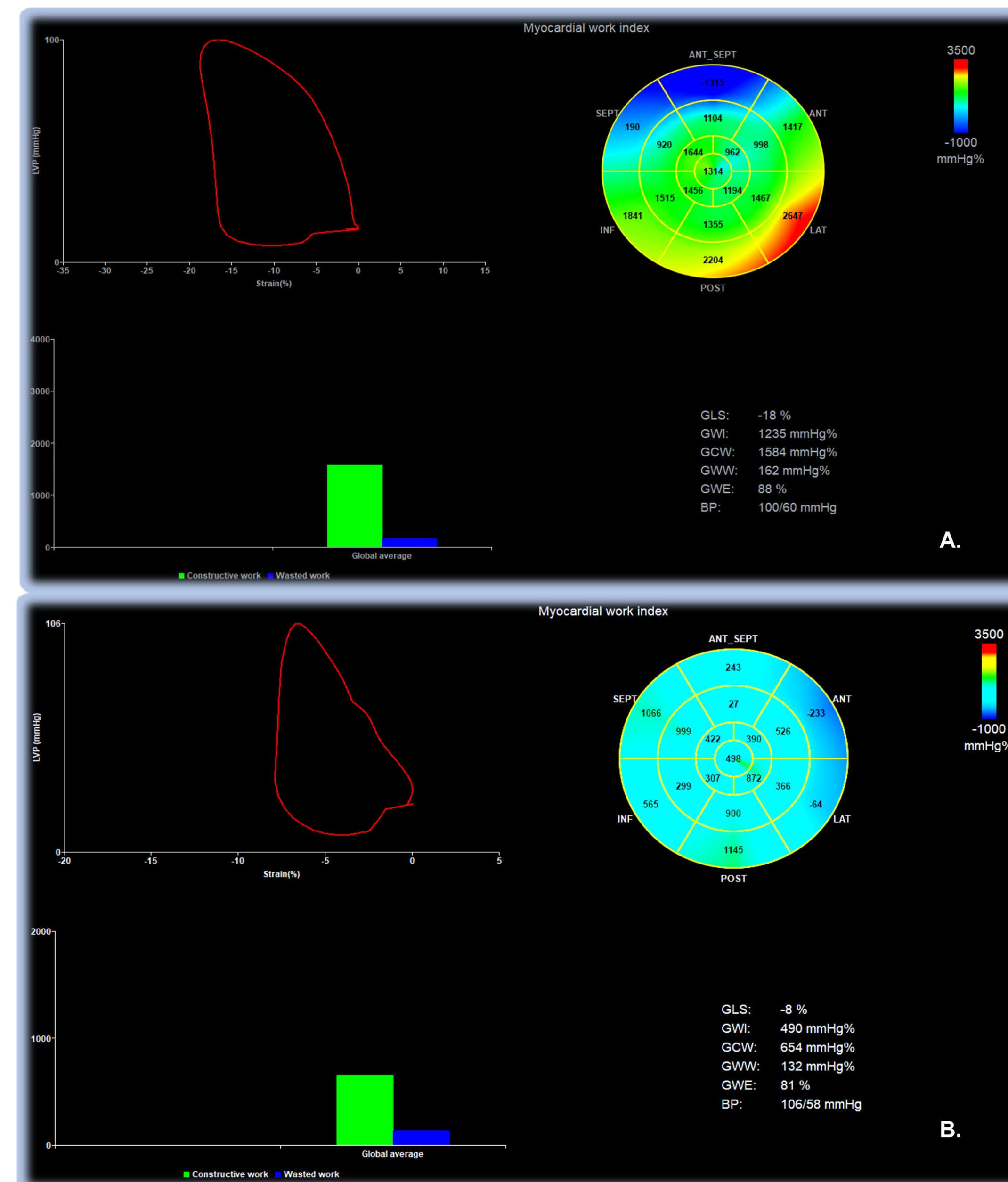

Fig 1. Noninvasive myocardial work analysis in Fontan patients with systemic LV (A) and systemic RV (B). Bar graphs demonstrate constructive work (green bar) vs wasted work (blue bar), and corresponding numerical work indices for each patient. Bull's eye demonstrates the regional distribution of GWI.
(A) Patient with systemic LV had normal GLS (-18%) yet a reduced GWE of 88%. Pressure-strain loop resembles the typical pressure-volume loop associated with a left ventricle.
(B) Patient with systemic RV has GLS (-8%) and GWE (81%). Pressure-strain loop resembles a typical pressure-volume loop associated with a right ventricle.
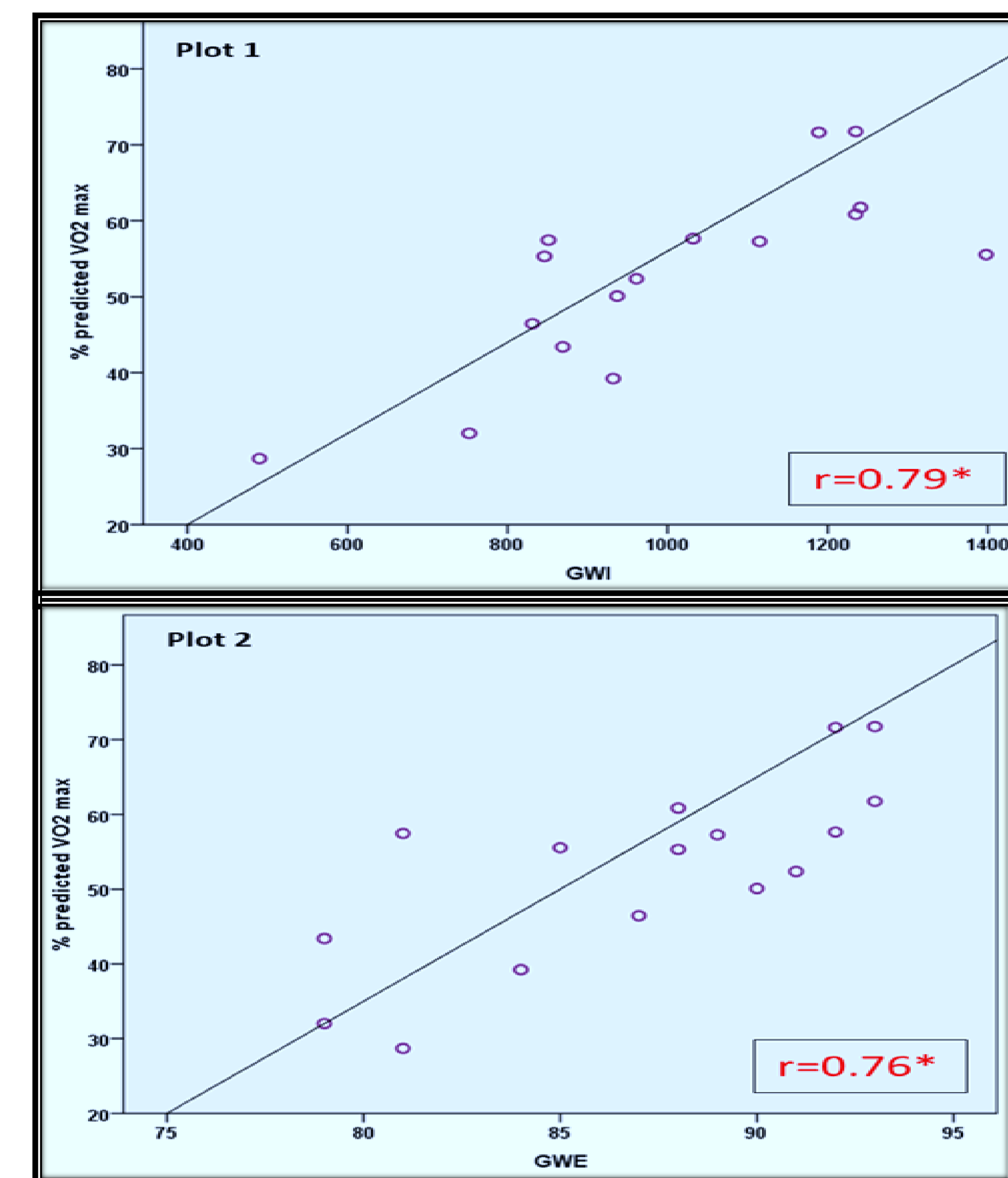

Fig 2. Scatter plots demonstrate a strong correlation of percentage of predicted max VO2 with GWI (plot 1) and GWE (plot 2).
* indicates a p-value of < 0.001.

CONCLUSIONS

Peak exercise capacity- a proven prognostic marker in the Fontan population, correlates strongly with GWI and GWE.

Therefore, indices of myocardial work by non-invasive pressure strain loops are feasible measures in Fontan patients that may provide new insights into risk stratification.

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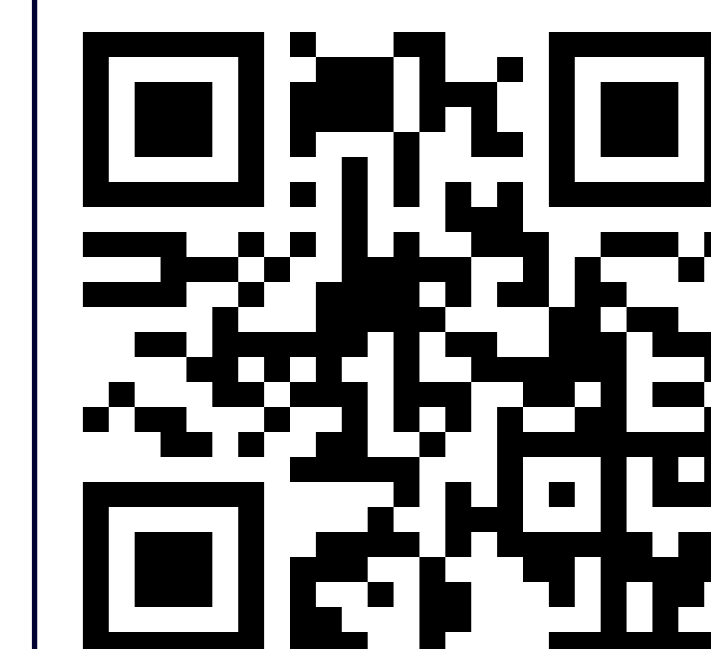
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We have no disclosures.