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Meeting abstract

1068 Prediction of pulmonary vascular resistance in patients with a left to right shunt by cardiac MRI

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Introduction

Late presentation of a large left to right shunt or the presence of significant respiratory co-morbidity may be associated with the development of pulmonary vascular disease. In this situation, invasive assessment of the pulmonary vascular resistance (PVR) is required in order to determine operability. Phase contrast MRI (PC-MRI) allows for the non-invasive assessment of arterial flow and left to right shunt. When combined with simultaneous cardiac catheterization it is possible to accurately determine the PVR.

Hypothesis

The PVR of patients with a large congenital defect can be predicted based on the magnitude of the left to right shunt assessed by PC-MRI.

Methods

All patients referred for MRI catheter assessment of the PVR with a large congenital defect that would result in a left to right shunt were eligible for inclusion. Exclusion criteria were pulmonary artery flow restriction in the form of a pulmonary artery band or bilateral branch pulmonary artery stenosis. MRI Cardiac Catheter was performed in a combined XMR suite with a 1.5 T Philips Intera Achieva Scanner and a single plane X-Ray unit. All studies were undertaken under general anaesthesia with ventilation to normocarbia. Invasive pressure measurements were obtained simultaneously with PC-MRI flows.

Results

MRI Cardiac Catheter was performed on 34 patients, 8 were excluded because of pulmonary artery flow restriction (7 pulmonary artery band, 1 bilateral branch pulmonary artery stenosis). 26 patients were included in the analysis. The majority were infants and children, median age 0.87 years (range 0.25 to 42.4 years). Of these, 12 patients had a ventricular septal defect, 11 an atrioventricular septal defect. Mean pulmonary artery pressure was 34.8 mmHg (± 10.9), mean shunt 2.47:1 (± 1.09) and mean PVR 5.47 WU.m^2 (± 3.53). PVR was also expressed as a resistance ratio (Rp:Rs), mean 0.29 (± 0.327). The absolute PVR value correlated strongly with the Rp:Rs, $r = 0.975$ ($p < 0.001$) (Fig 1). Qp:Qs was significantly associated to the PVR by an exponential relationship ($p < 0.001$) resulting in univariate prediction formula of (Fig 2)

Conclusion

Pulmonary vascular resistance can be expressed as either an absolute value indexed to body surface area or as a resistance ratio. We have demonstrated that under general anaesthesia, the indexed PVR and the resistance ratio correlate strongly, implying that both are a valid measure of pulmonary vascular resistance in this setting.

There is a significant exponential relationship between the PVR and the net shunt which can be calculated by PC-MRI. In future, this model may be applied to patients with a large shunt to predict the PVR and possibly avoid the need for invasive catheter assessment prior to surgery.

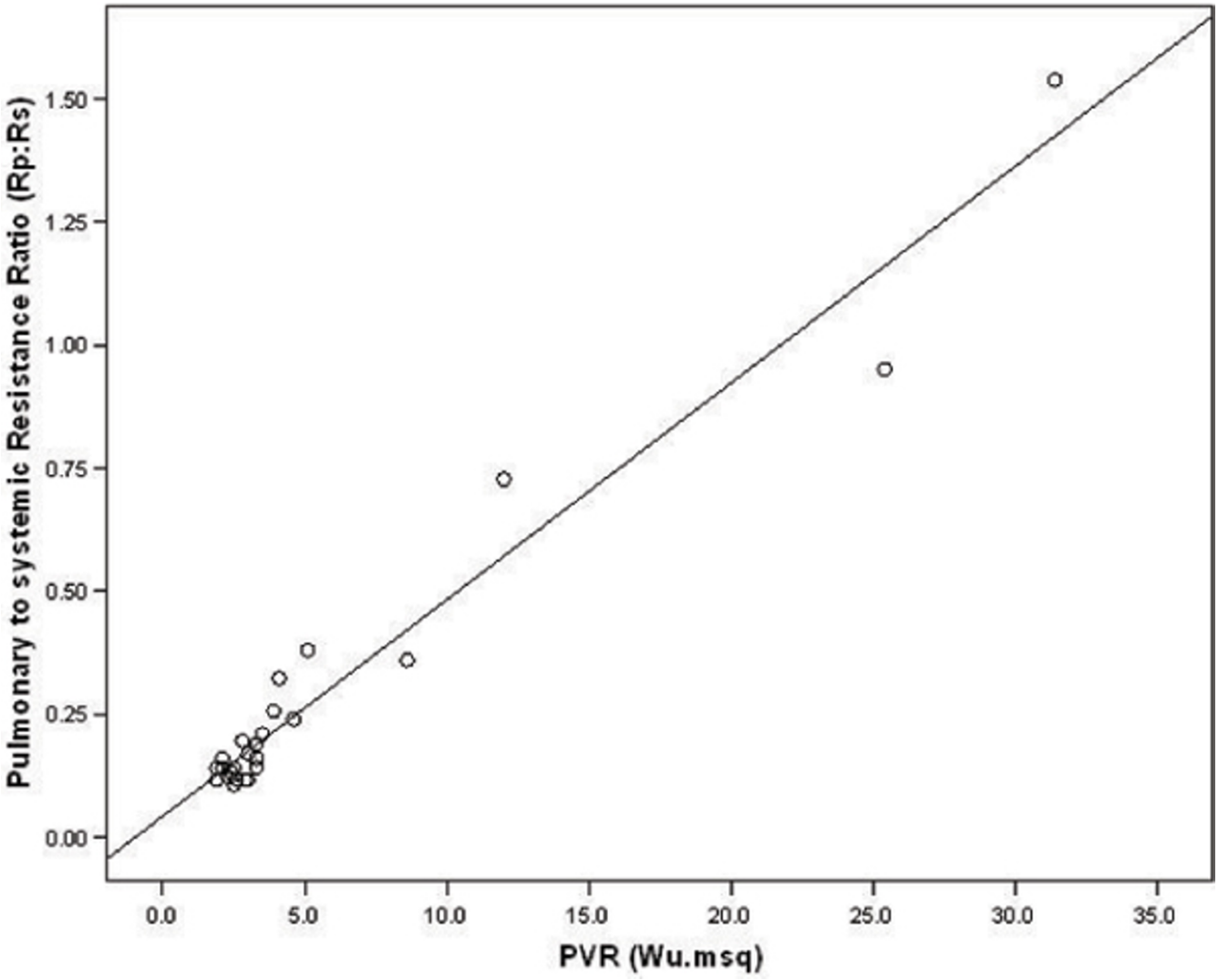

Figure 1
Plot of resistance ratio (RP:Rs) vs absolute PVR.

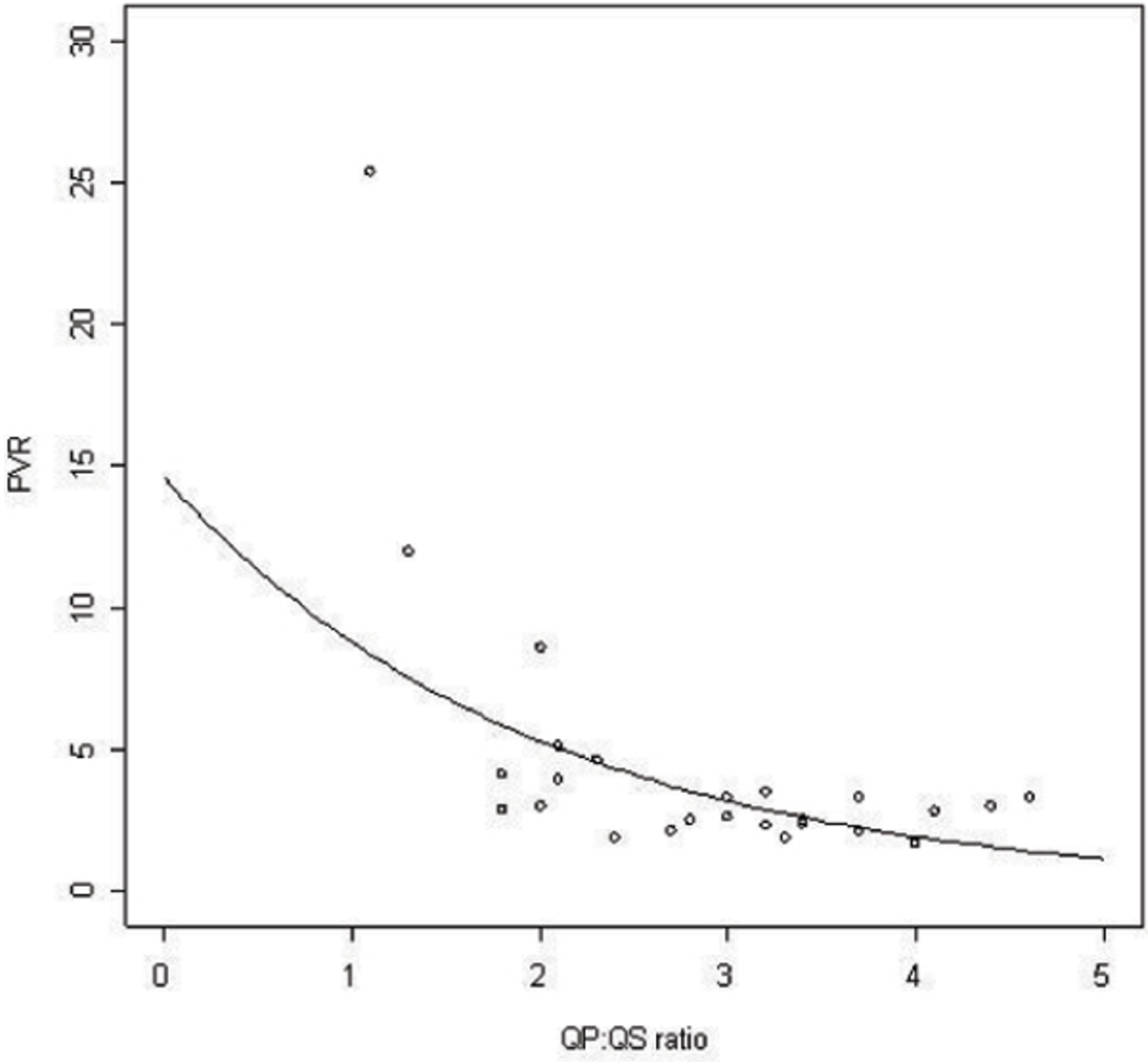

Figure 2
Plot of PVR (WU.m^3) vs net shunt (Op:Os).