Correlation between Basic Pulmonary Hemodynamics and Pulmonary Vascular Resistance in Children with Pulmonary Hypertension associated with Congenital Heart Disease

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Background:

Invasive pulmonary hemodynamic assessment remain the gold standard in diagnosis of pulmonary hypertension. Particulary in children with congenital heart disease (CHD) with systemic-to –pulmonary shunt, cardiac catheterization will provide data to determine whether the individual child has pulmonary hypertension related with the increase pulmonary blood flow or elevated pulmonary vascular resistance(PVR) .Derived calculated PVR has been routinely utilized to evaluate children with pulmonary arterial hypertension associated with congenital heart disease (aPAH/CHD). Debatable whether the PVR is the ideal parameter to reflect the severity of aPAH/CHD due to the derived calculated value depends on oxygen consumption which is difficult and complicated to obtain the accurate value. To avoid using the oxygen consumption, the ratio between the PVR and systemic vascular resistance or Rp/Rs has been used instead of PVR.

The objective of this study is to define whether the basic pulmonary hemodynamic parameters could be used as parameters to correlate with PVR and Rp/Rs .

Methods:

The data of patients with pulmonary hypertension related to CHD underwent cardiac catheterization was retrospectively review . All derived hemodynamic data were recalculated.

Derived calculated PVR was calculated from mean transpulmonary pressure gradient (mTPG) divided by the pulmonary blood flow. The PVR was tested and showed to be directly correlated with the Rp/Rs.

The pulmonary hemodynamics especially

- Mean pulmonary pressure (mPAP)
- diastolic pulmonary pressure (dPAP)
- diastolic pressure gradient (DPG): difference between the dPAP and pulmonary capillary wedge pressure
- pulmonary pulse pressure (PPP) :difference between the systolic pulmonary pressure and dPAP

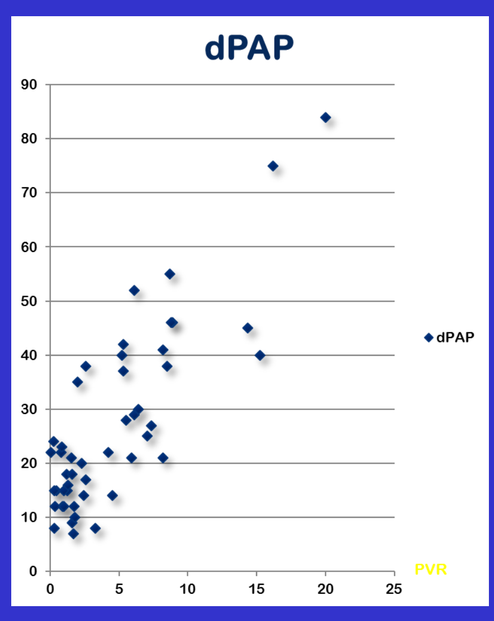
were compared and correlated with the PVR. The sensitivity and specificity of the pulmonary hemodynamic threshold value predict the PVR were determined.

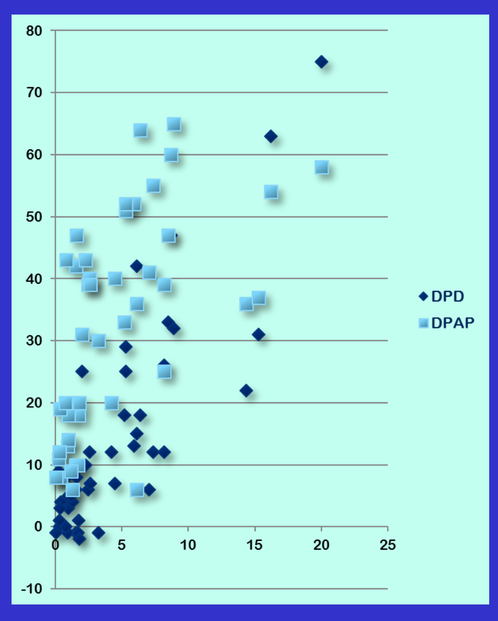
Results:

The cardiac catheterization data of 50 children (mean age 5.97 years , range 6 months to 18 years, 25 male) was retrospectively reviewed.

The PVR was tested and showed to be directly correlated with the Rp/Rs, r=0.86 with significant at the level of 0.01.

The dPAP, DPG and PPP were correlated with the PVR, r= 0.83, 0.84 and 0.67 (p=0.01) respectively.





In order to utilized the hemodynamic parameter in clinical practice, PVR value of 6 WU was used to define the cut point number of each pulmonary hemodynamic as presented in the following table.

Hemodynamic Parameter	Sensitivity (%)	Specificity (%)	Area under the curve
mPAP> 51 mmHg	80	97.9	0.9
dPAP>24.5 mmHg	93	81.8	0.9
DPG>14 mmHg	80	78.8	0.9
PPP>32 mmHg	87	63.6	0.8

Discussion:

The calculated PVR has been derived from the pulmonary pressure and pulmonary blood flow. Therefore, the basic measurement of pulmonary circulation would have an impact on PVR calculation especially the mPAP which is used to calculated the PVR. In this study, the basic pulmonary hemodynamic measurement particularly the dPAP and DPG had great correlation with the PVR and could be used as a simple parameter to help to define the pulmonary arterial hypertension in children with congenital heart .

Conclusion:

The basic pulmonary hemodynamics particularly the dPAP and DPG could be used to assess the severity of aPAH/CHD in children with reasonable correlation with the PVR. The dPAP has a better prediction of the PVR in comparison with the DPG and PPP.