

Eur J Cardiothorac Surg. 2011 Mar;39(3):e13-21. Epub 2010 Dec 3.

Aortic atresia is associated with an inferior systemic, cerebral, and splanchnic oxygen-transport status in neonates after the Norwood procedure.

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Abstract

OBJECTIVE:

Aortic atresia (AA) is a risk factor for mortality after the Norwood procedure. The mechanisms remain unknown. We compared the profiles of systemic, cerebral, and splanchnic oxygen transport in neonates with hypoplastic left-heart syndrome with AA or aortic stenosis (AS) after the Norwood procedure.

METHODS: Systemic oxygen consumption (VO_2) was measured using respiratory mass spectrometry for 72 h in 17 neonates (nine in the AA group, eight in the AS group). Cardiac output (CO), systemic vascular resistance (SVR), oxygen delivery (DO_2), and oxygen extraction ratio (ERO_2) were calculated combining with blood gases and pressures at 2-4-h intervals. Cerebral (ScO_2) and splanchnic (SsO_2) oxygen saturations were measured by near-infrared spectroscopy. The doses of dopamine, milrinone, phenoxybenzamine, and vasopressin were recorded. Preoperative echocardiographic left-ventricular morphology and ejection fraction ratio were measured.

Results:

Compared with the AS group, the AA group had lower CO ($p = 0.03$), higher SVR ($p = 0.002$), lower DO_2 ($p = 0.07$), VO_2 ($p = 0.003$), and ScO_2 ($p = 0.07$) during the first 40 h. SsO_2 was insignificantly lower. Despite a similar ERO_2 , the AA group had higher lactate ($p = 0.01$). The AA group received higher doses of milrinone ($p < 0.0001$), vasopressin ($p = 0.005$), and phenoxybenzamine ($p = 0.02$), and lower higher doses of dopamine ($p = 0.07$). Vasopressin adversely correlated with systemic oxygen-transport variables and SsO_2 ($p < 0.05$). The AA group had thicker left-ventricular posterior wall ($p = 0.05$) that was negatively correlated with CO ($p = 0.02$).

Conclusions:

AA is associated with an inferior status of systemic, cerebral, and splanchnic oxygen transport after the Norwood procedure. Aggressive use of vasopressin may worsen systemic oxygen transport and decrease splanchnic perfusion.