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Cardiopulmonary bypass is associated with insulin resistance and inflammation in congenital heart disease with or without increased pulmonary blood flow

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Objective: Cardiopulmonary bypass (CBP) is associated with inflammation and altered glucose metabolism. Increased pulmonary blood flow (PBF) has been shown to affect circulating and tissue cytokine levels in children with left-to-right cardiovascular shunt lesions.

Aim: To analyze blood plasma concentrations of proinflammatory cytokines, insulin, and insulin-sensitizer adiponectin in infants with congenital heart disease (CHD) pre and post CPB. To assess whether cytokine levels are correlated with low cardiac output syndrome (LCOS) after CBP.

Methods: We conducted a prospective study including 58 infants, who underwent CBP (normal or decreased PBF: ToF n=19; increased PBF: VSD n=24, AVSD n=9; single ventricle: HLHS n=6). Plasma cytokine, insulin and adiponectin levels were measured by RIA and ELISA.

Results: There were no significant differences in the plasma levels of TNF-alpha, IL-6, IL-10, MCP-1, and RANTES between the 4 CHD groups, before and after CPB. IL-6 levels increased after CPB in all groups, while TNF-alpha and RANTES decreased after CPB in ToF and VSD. IL-10 and MCP-1 expression did not change after CPB. Postoperative LCOS was associated with higher MCP-1 and lower RANTES levels before and after CPB, and higher TNF-alpha levels after CPB. Insulin levels before CPB were significantly higher (5-8 fold) in HLHS patients compared to all other groups. After CPB, insulin increased in ToF and VSD patients, while adiponectin decreased by 30-60 % in all 4 groups. Patients with VSD or AVSD had the highest plasma adiponectin levels, both before and after CPB.

Conclusion: CPB is associated with inflammation and insulin resistance. A differential immunomodulatory plasma cytokine pattern exists in children with LCOS after CPB (MCP-1 and TNF-alpha increased, RANTES decreased). While infants with VSD or AVSD (i.e., increased PBF) have higher vasoprotective adiponectin levels after CPB, proinflammatory markers do not correlate with PBF.