

P-233

Norwood patients possess mild inferior cardio-pulmonary circulations even after Fontan procedure

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Introduction: We perform Norwood procedure (NWD) against patients with hypoplastic left heart syndrome. Post-NWD patients almost all possess unstable hemodynamic status with small PA before Glenn, even after Glenn. We predicted NWD patients, who developed the condition for Fontan, would still possess inferior cardio-pulmonary performances. We investigated cardio-pulmonary circulation in Fontan patients with a history of NWD.

Methods: The medical records of 156 Fontan patients were reviewed who underwent cardiac catheterization between 2010 and 2017. We divide them into 2 groups: patients who were performed Norwood procedure before Glenn (NWD: n=34) and patients who did not have history of Norwood (non-NWD: n=122). We compared cardio-pulmonary performances between NWD group and non-NWD group.

Results: We inserted conduit to pulmonary arteries on NWD and removed them on Fontan in all NWD patients. As to ventricular performances, ventricular volumes on end-systole were larger in NWD group than in non-NWD group (31 vs. 26 ml/m²: p=0.036). Ventricular ejection fractions were lower in NWD (52% vs. 56%: p=0.023). With regard to pressure studies, The patients rate with higher pressures of pulmonary capillary wedge (≥ 8 mmHg) was higher in Nor group (25% vs. 6%: p=0.025). There were no significant differences in other cardiac performances between two groups. As for pulmonary circulation, the ratio of patients with smaller pulmonary indexes (<145 mm/m²) was higher in NWD (25% vs. 6%: p=0.012). However, the ratio of patients was higher in NWD group (61% vs. 31%: p=0.0011) who undertook percutaneous transcatheter angioplasties. Pressures of superior vena cava were almost same between two groups; pulmonary resistances were not significantly different. Significant differences in the frequency of internal remedies did not existed between NWD and non-NWD, such as diuretics, vasodilators, beta antagonist, and pulmonary vasodilators. For enalapril and carvedilol, dosage amounts were not significantly different between two groups.

Discussion: Our study showed traces of unstable cardio-pulmonary circulation subsisted in NWD group even after Fontan procedure, especially cardiac systolic hypo-function and narrow pulmonary artery size. However, extent of internal medicines was not different at all between NWD and non-NWD. Patients after Norwood procedure continuously need intense medical management after Fontan procedure.