Exercise capacity in children after total cavopulmonary connection; lateral tunnel versus extracardiac conduit technique.

Erasmus Medical Centre, Rotterdam, The Netherlands (1)
Academic Medical Centre, Amsterdam, The Netherlands (2)
Leiden University Medical Centre, Leiden, The Netherlands (3)
University Medical Center Utrecht, Utrecht, The Netherlands (4)

Introduction
In patients with univentricular heart disease the total cavopulmonary connection (TCPC) has been the preferred technique for the last 20 years. Since the introduction, mortality and morbidity of the Fontan operation have improved vastly. Limited exercise tolerance remains a problem. It is not clear if exercise tolerance differs between both available techniques (i.e. intra-atrial lateral tunnel (ILT) or extracardiac conduit (ECC)) in the modern, 2-stage approach of the Fontan circulation. Purpose of this study was to compare exercise testing results between these two groups.

Methods
82 Fontan patients (50 male) with a TCPC, age 12.4±2.6 years, age at TCPC completion 3.2±1.4 years, successfully underwent cardiopulmonary exercise testing (CPET) (peak respiratory exchange rate (RERpeak) >1.00) on a bicycle ergometer. Peak workload (Wpeak), peak heart rate (HRpeak), peak VO2 (VO2peak) and VE/VCO2-slope were determined. Predicted values were derived from a group of healthy controls. A distinction was made between ILT (n=33) and ECC (n=49) modifications of the TCPC-technique.

Results:
For the entire group mean RERpeak was 1.08±0.05, mean Wpeak was 70±16%, mean VO2peak was 73±15%, median VE/VCO2 slope was 107% (interquartile range (IQR) 16%) and mean HRpeak (170±18/min) was 91±10% of the predicted value.

There was no difference in age at time of the test between the 2 groups (13.0±3.0 (ILT) vs. 11.9±2.2 (ECC) years, p=0.77).

Outcomes for the ILT and ECC group were comparable for percentage of predicted values of Wpeak (66±17% vs. 71±15%, p=0.134), HRpeak (90±6% vs. 92±11%, p=0.358) and VE/VCO2-slope (105% (IQR 24%) vs. 109% (IQR 14%), p=0.98). The reached percentage of predicted VO2peak was lower for the ILT group compared to the ECC group (69±14% vs. 76±16%, p=0.046).

Conclusion:
CPET parameters Wpeak, VO2peak and HRpeak and VE/VCO2-slope are impaired in contemporary Fontan patients. The results are comparable for ILT and ECC techniques concerning most values. However the percentage of predicted VO2peak was lower in patients with an intra-atrial lateral tunnel. These results show that reduced exercise capacity remains an important issue in Fontan patients. The ECC modification might have a slightly more favorable outcome for exercise capacity at medium term follow up.