# [Relation Between Exercise Capacity and Extracardiac Conduit Size in Patients with Fontan Circulation.](https://www.ncbi.nlm.nih.gov/pubmed/31473799)

Lee SY, Song MK, Kim GB, Bae EJ, Kim SH, Jang SI, Cho SK, Kawk JG, Kim WH, Lee CH, Kim HJ, Kim J.

Pediatr Cardiol. 2019 Dec;40(8):1584-1590. doi: 10.1007/s00246-019-02190-4. Epub 2019 Aug 31.

PMID: 31473799

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**Take Home Points:**

* Conduit size is one of the determinants of preload in an extracardiac Fontan circuit.
* Its affect onto exercise capacity is independent of gender, age of Fontan operation, ventricular morphology, isomerism and the presence of fenestration in the Fontan circuit.
* Patients in the study demonstrated highest exercise capacity when the conduit size is 12.5mm/m2
* Based on the calculation above, the optimum conduit size should be 16-18mm.



***Commentary from Dr. M.C. Leong (Kuala Lumpur), section editor of ACHD Journal Watch:*** In extracardiac Fontan, the conduit size is one of the key factors that determines the preload to the Fontan circuit. Larger conduit may cause flow energy loss and increase the risk of thrombosis due to stagnation of blood flow. Meanwhile, smaller conduit may increase the flow resistance. In this study, the authors sought to determine the optimal size of extracardiac Fontan conduit by comparing exercise capacity with each conduit size to see which yielded the best exercise capacity.

150 patients (male: female = 97:53; mean age :17.5 ± 5.1 years) who had undergone extracardiac Fontan completion was retrospectively reviewed. All these patients underwent cardiopulmonary exercise with expiratory gas analysis using Bruce protocol. Invasively measured central venous pressure was 12.4 ± 2.5mmHg while the pulmonary vascular resistance was 1.2 ± 0.5 Woods unit. Non-linear association between conduit diameter per body surface area (BSA) and predicted peak VO2 was computed. The authors found maximum peak VO2 at about 12.7mm/m2 conduit diameter. VE/VCO2 was lowest at 12.4mm/m2 conduit diameter and that patients had maximum exercise capacity when the conduit diameter is 12.5mm/m2 (Figure 1). This was not affected by gender, the age of Fontan operation, ventricular morphology, isomerism and the presence of fenestration in the Fontan circuit (Table 3).



 The authors found that conduit size 16 and 18mm to be optimal, taking into account that a body surface area of 1.57m2 in a normal adult (1.57 x 12.5mm). They also noted that although 16mm and 24mm conduit are 4mm different from a 20mm conduit in terms of diameter, the area difference is not proportional to the difference in the diameter change (Figure 2). Area difference is less if a smaller conduit is used. The authors, therefore cautioned the use of bigger conduits when fashioning the extracardiac Fontan circuit.



Often, surgeons prefer a larger conduit over a smaller one to give allowance for growth. Unfortunately, such a decision may lead to a poorer exercise capacity, which presumably due to a higher flow energy loss and a lower preload. This paper has elegantly demonstrated so.