## 1 Abstract

2 Fenestration has been reported to enhance Fontan hemodynamics in several cases of 3 Fontan circulation. However, the indication criteria for fenestration remain under 4 discussion. To assess the effectiveness of fenestration in Fontan circulation, we conducted 5 a theoretical analysis using a computational model of the fenestrated Fontan circulation. 6 The cardiac chambers and vascular systems were modeled using the time-varying 7 elastance model and the modified Windkessel model, respectively. When the pulmonary 8 vascular resistance index was 4.01 Wood Units m<sup>2</sup>, fenestration significantly reduced 9 central venous pressure from 18.0 to 16.1 mmHg and decreased stressed blood volume 10 from 610 to 555 ml. However, in the models with reduced ventricular end-systolic 11 elastance, increased ventricular stiffness constant, or heightened systemic vascular 12 resistance, the advantages of fenestration were diminished. Thus, fenestration may 13 effectively improve the hemodynamics of Fontan circulation in patients with elevated 14 pulmonary vascular resistance.

15

## 16 Keywords

Single ventricle, Fontan circulation, fenestration, hemodynamic simulation, lumpedparameter model

19