## 1 Abstract

## 2 Background.

Controlling pulmonary blood flow in patients who have undergone Norwood palliation, 3 4 especially early postoperatively, is challenging due to a change in the balance of systemic 5 and pulmonary vascular resistance. We applied a combination therapy of clipping and 6 balloon angioplasty for right ventricle - pulmonary artery (RV-PA) shunt to control 7 pulmonary blood flow, but the influence of the combination therapy on the PA condition is uncertain. 8 9 Methods. 10 Retrospectively analysis was conducted of all infants with hypoplastic left heart 11 syndrome who had undergone Norwood palliation with RV-PA shunt at Okayama

12 University Hospital from January 2008 to September 2022.

13 *Results.* 

A total of 50 consecutive patients underwent Norwood palliation with RV-PA shunt in this study period. Of them, 29 patients underwent RV-PA shunt flow clipping, and the remaining 21 <del>patients</del> had unclipped RV-PA shunt. <del>23</del> Twenty-three patients underwent balloon angioplasty for RV-PA shunt with clips. After balloon angioplasty, oxygen saturation significantly increased from 69 (59-76) % to 80 (72-86) % (p<0.001), and the

1	narrowest portion of the clipped conduit significantly improved from 2.8 (1.8-3.4) mm to
2	3.8 (2.9-4.6) mm ( $p$ <0.001). In cardiac catheterizations prior to Bidirectional cavo-
3	pulmonary shunt (BCPS), there were no significant differences in pulmonary-to-systemic
4	flow ratio (Qp/Qs), ventricular end-diastolic pressure, Nakata index, arterial saturation,
5	mean pulmonary artery pressure and pulmonary vascular resistance index. On the other
6	hand, in Cardiac catheterizations prior to Fontan, Nakata index was larger in the clipped
7	group (p=0.02). There was no statistically significant difference in the 5-year survival
8	between the two groups (clipped group 96%, unclipped group 74%, log-rank test: p =
9	0.13).

## 10 Conclusion.

At least, our combination therapy of clipping and balloon angioplasty for RV-PA shunt did not negatively impact PA growth. Although there is a trend toward better but not statistically significant difference in outcomes in the clipped group compared to the nonclipped group, this treatment strategy may play an important role in improving outcomes in hypoplastic left heart syndrome.