Outcomes following percutaneous intervention to obstructed right ventricle to pulmonary artery shunts after the modified Norwood procedure

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Introduction:
Stenosis of the right ventricle to pulmonary artery (RV-PA) shunt following modified Norwood operation leads to early oxygen desaturation and may contribute to interstage morbidity and mortality. We sought to evaluate the efficacy of percutaneous interventions for severely desaturated patients with RV-PA shunt stenosis.

Material and Methods:
Between 01/2006 and 06/2014, 22 patients (17 with true HLHS) underwent 24 catheterizations for dilation of obstructed RV-PA conduit at a median interval of 163 days (range 3-434) after the Norwood operation. Median age and weight was 157 days (range 19-450) and 5.4 kg (2.8-10.1) respectively. Four patients required intervention early after the Norwood operation, and 2 patients required dilation of an interstage replacement RV-PA conduit. Eighteen patients had discreet obstruction: 11 at the proximal end, one in the mid portion and 6 at the distal end. The remaining 4 patients had multilevel stenosis.

Results:
Balloon dilatation was performed in 17 patients, followed by stent implantation in 3 patients. Two patients had isolated stent implantation. Minimum shunt diameter of the stenosis and arterial oxygen saturations increased from 2.4 ± 0.5mm to 4.3 ± 0.6mm and 58.7 ± 15.9% to 79.4 ± 9.9%, respectively. The mean diameter of the right and left pulmonary artery and pulmonary index was 5.75 ± 1.7mm, 5.6 ± 1.8mm and 185.7 ± 94.4, respectively. Nine patients required additional interventions including pulmonary artery balloon dilation (5), aortic arch balloon dilation (2), pulmonary artery (1) or atrial septal (1) stent implantation. There were 4 in-hospital deaths, with a mean hospital stay for the remainder of 21.8 ± 14.6 days. Two patients died after discharge before the second stage of palliation, and 2 patients had RV-PA shunt exchange after interventional dilation due to inadequate pulmonary artery growth. Of the remaining 16 patients, 12 have undergone bidirectional Glenn.

Conclusions:
Percutaneous treatment of a stenotic RV-PA shunt is effective and may facilitate a reduction in shunt-related surgical interventions. Isolated balloon angioplasty is often sufficient, however selected patients may require stent implantation to maintain conduit patency.