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Ventricular assist devices in pediatric cardiomyopathy and congenital heart disease patients: an analysis from the German National Register for Congenital Heart Defects

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Introduction
Heart failure is a major contributor to morbidity and mortality in pediatric cardiomyopathy and congenital heart disease (CHD) patients. Advanced therapies for heart failure like ventricular assist devices (VAD) are increasingly used in patients with acquired heart disease. Limited data exists, however, on the use and outcome of this technology in pediatric cardiomyopathy and CHD patients.

Methods
Patients who were supported with a VAD were identified from the German National Register for Congenital Heart Defects. We report patient demographics, underlying cardiac defect, status of surgical repair/palliation, associated conditions, complications, and 30-day and overall mortality in this population. Univariate regression analysis was performed to identify predictors of an adverse outcome.

Results
Overall, 91 patients (median age 4.29 years [IQR, 0.44-15,96], 45.1% female) received a VAD. 45 pat. (49.5%) had a congenital heart defect, while 46 (50.5%) were reported as cardiomyopathy. The type of VAD implanted was Berlin Heart in 31 pat. (34.1%), Heartware in 16 (17.6%), Levitronix in 9 (9.9%), unknown in 28 (30.8%). In 67 pat. (73.6%) the systemic ventricle was supported, in 4 (4.4%) the subpulmonary ventricle, and in 20 (22.0%) both. Reasons for implantation were heart failure in 46 (50.5%), post-surgery in 24 (26.4%), transfer from ECMO in 16 (17.6%), and miscellaneous in 5 (5.5%). At least one complication occurred in 54 pat. (59.3%) such as bleeding (n=37), thrombosis (n=15), embolic (n=19), 20 of which involved cerebral complications.
Cause for explantation was clinical improvement in 22 (24.2%), death in 22 (24.2%), heart transplantation in 39 (42.9%), and change to ECMO in 3 (3.3%). Overall, 30-day mortality rate was 19.8%. Longer term all-cause mortality rate was 39.6%. On unvariate regression analysis, no significant predictor could be identified for 30-day mortality. For all-cause mortality, age at implantation (OR:1,12; 95%CI 1.06 to 1.18, $p<0.0001$) and the presence of a congenital heart defect (OR: 4.92; 95%CI 1.97 to 12.32, $p<0.001$) were the only univariate predictors.

Conclusions
The use of VAD for heart failure in pediatric cardiomyopathy and CHD patients is increasing. Even though, mortality remains high in this cohort, reflecting the complexity of this particular patient population presenting with heart failure.