

Supplemental Material

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Table S1. Type of specific PVR of study population

Type of specific PVR, N (%)	N=1598	PVR with IE, N (%)
Contegra® conduit	445 (27.9)	24 (5.4)
Aortic homograft	363 (22.7)	5 (1.4)
Melody™ transcatheter pulmonary valve	241 (15.1)	18 (7.5)
Pulmonary homograft	190 (11.9)	2 (1.1)
Hancock® Bioprosthetic Valved Conduit	157 (9.8)	5 (3.2)
Edwards SAPIEN© valve	52 (3.3)	0
Carpentier-Edwards© valved conduit	30 (1.9)	0
Matrix Patch™	24 (1.5)	1 (4.2)
Labcor® Valved Pulmonar Conduit	22 (1.4)	0
St. Jude Medical	18 (1.1)	0
Shelhigh Pulmonic Valve Conduit	14 (0.9)	0
MatrixPplus	13 (0.8)	1 (7.7)
Capentier-Edwards PERIMOUNT ©	12 (0.8)	0
Carbomedics®	6 (0.4)	0
Dacron® valved conduit	6 (0.4)	0
MHH TE homograft	5 (0.3)	0

IE, infective endocarditis; PVR, pulmonary valve replacement

Table S2. Underlying congenital heart disease diagnoses of study population

Principal Diagnosis according to EPCC	EPCC code	Category of CHD	No. of Patients, N (%)	Male sex, N (%)	Age at first PVR, yrs*	Age at study inclusion, yrs*
			1170	659 (56.3)	5 (0-14)	12 (5-20)
Tetralogy of Fallot	01.01.01	1†	376 (32.1)	190 (50.5)	13 (5-21)	17 (10-27)
Common arterial trunk (truncus arteriosus)	09.01.01	2‡	156 (13.3)	74 (47.4)	0 (0-0)	7 (2-14)
Aortic valvar stenosis: congenital	09.15.01	3§	95 (8.1)	73 (76.8)	9 (3-15)	12 (5-19)
Pulmonary atresia + ventricular septal defect (VSD) + systemic-to-pulmonary collateral artery(ies) (MAPCA(s)),	01.01.25	1†	93 (8.0)	54 (58.1)	2 (1-7)	7 (3-14.5)
Pulmonary atresia + ventricular septal defect (VSD) (including Fallot type)	01.01.06	1†	82 (7.0)	46 (56.1)	1 (0-4)	9 (5-17)
Pulmonary valvar stenosis: congenital	09.05.04	3§	49 (4.2)	34 (69.4)	17 (10-27)	19 (12.5-29.5)
Discordant ventriculo-arterial connections (TGA)	01.05.01	2‡	47 (4.0)	29 (61.7)	3 (0-10)	8 (1-17)
Double outlet right ventricle: Fallot Type (subaortic or doubly committed ventricular septal defect & pulmonary stenosis)	01.01.17	2‡	47 (4.0)	29 (61.7)	1 (0-10)	5 (1-13)
Double outlet right ventricle: transposition type (subpulmonary ventricular septal defect)	01.01.18	2‡	45 (3.9)	31 (68.9)	2 (0-6.5)	8 (1-13)
Pulmonary atresia + intact ventricular septum	01.01.07	3§	29 (2.5)	18 (62.1)	8 (3.5-12.5)	12 (8-17)
Absent pulmonary valve syndrome: Fallot-type	09.05.25	1†	19 (1.6)	7 (36.8)	2 (0-13)	11 (1-15)
Congenitally corrected transposition of great arteries (discordant atrioventricular & ventriculo-arterial connections)	01.01.03	2‡	16 (1.4)	7 (43.8)	6 (2-18)	23 (5-27)
Others			100 (8.6)	58 (58.0)	7.5 (1-16)	13 (4-21)

EPCC. European Paediatric Cardiac Code (IPCCC Short List) - 1 April 2012, with ICD-9, ICD-10, STS/EACTS Short List crossmapping; CHD, congenital heart defect.

* Median (interquartile range)

† Tetralogy of Fallot and variants

‡ Atrioventricular and-or ventriculo-arterial connections abnormal

§ Abnormalities of ventriculo-arterial valves and great arteries

Table S3. Specific pathogens in IE of PVR

	Patients	Melody (18)	Total (38)	SPVR		
				Heterograft (hancock and others) (7)	Contegra (24)	Homograft (7)
Staphylococcus	18 (32.1)	11 (61.1)	7 (18.4)	1 (14.3)	4 (16.7)	2 (28.6)
Staphylococcus aureus	11 (19.6)	8 (44.4)	3 (7.9)	0	3 (12.5)	0
Staphylococcus epidermidis	3 (5.4)	1 (5.6)	2 (5.3)	1 (14.3)	0	1 (14.3)
Staphylococcus hominis	1 (1.8)	0	1 (2.6)	0	0	1 (14.3)
Staphylococcus lugdunensis	1 (1.8)	1 (5.6)	0	0	0	0
Staphylococcus sanguinus	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Other coagulase-negative staphylococci	1 (1.8)	1 (5.6)	0	0	0	0
Streptococcus	15 (26.8)	5 (27.8)	10 (26.3)	3 (42.9)	7 (25.9)	0
Streptococcus gordonii	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Streptococcus anginosus	2 (3.6)	1 (5.6)	1 (2.6)	0	1 (4.2)	0
Streptococcus intermedius	1 (1.8)	1 (5.6)	0	0	0	0
Streptococcus mitis	2 (3.6)	0	2 (5.3)	2 (28.6)	0	0
Streptococcus oralis	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Streptococcus oralis / mitis	1 (1.8)	1 (5.6)	0	0	0	0
Streptococcus parasanguinis	2 (3.6)	1 (5.6)	1 (2.6)	0	1 (4.2)	0
Streptococcus sanguinis	3 (5.4)	0	3 (7.9)	1 (14.3)	2 (8.3)	0
Streptococcus viridans	1 (1.8)	1 (5.6)	0	0	0	0
Other streptococci	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Abiotrophia defectiva	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Brevibacterium spp.	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0

Cardiobacterium hominis	1 (1.8)	0	1 (2.6)	1 (14.3)	0	0
Coxiella burnetti	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Enterococcus faecium	1 (1.8)	0	1 (2.6)	0	0	1 (14.3)
Oligella ureolytica	1 (1.8)	0	1 (2.6)	1 (14.3)	0	0
Rothia mucilanginosa	1 (1.8)	1 (5.6)	0	0	0	0
Candida	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Negative blood culture	1 (1.8)	0	1 (2.6)	0	1 (4.2)	0
Not available	14 (25)	1 (5.6)	13 (34.2)	1 (14.3)	8 (33.3)	4 (57.1)

IE, infective endocarditis; PVR, pulmonary valve replacement

Table S4. Impact factors on the occurrence of IE in univariable Cox-regression

Subgroup	All patients		Female sex		Male sex		Patients <18 years at study inclusion		Patients ≥18 years at study inclusion	
	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value
Type of PVR										
Homograft	1		1		1		1		1	
Heterograft Excl. Contegra	2.60 (0.91-7.43)	0.074	2.44 (0.15-39.06)	0.528	2.76 (0.89-8.58)	0.079	3.14 (0.89-11.15)	0.076	1.19 (0.12-11.41)	0.883
Contegra	5.62 (2.42-13.07)	<0.001	13.55 (1.69-108.48)	0.014	4.25 (1.65-10.91)	0.003	5.12 (1.75-14.97)	0.003	8.06 (1.63-39.98)	0.011
Melody	7.81 (3.20-19.05)	<0.001	22.90 (2.78-188.30)	0.004	5.01 (1.79-14.01)	0.002	6.05 (1.89-19.40)	0.002	12.05 (3.00-48.32)	<0.001
PVR size (mm) *	0.97 (0.89-1.04)	0.371	0.95 (0.82-1.11)	0.545	0.96 (0.88-1.06)	0.417	1.02 (0.93-1.12)	0.610	0.85 (0.65-1.11)	0.233
Sex										
Female	1		-		-		1		1	
Male	1.95 (1.10-3.44)	0.022	-		-		2.03 (1.02-4.04)	0.044	1.57 (0.54-4.51)	0.407
Number of previous PVR	1.63 (1.23-2.17)	<0.001	1.41 (0.82-2.40)	0.214	1.71 (1.22-2.39)	0.002	1.71 (1.21-2.42)	0.002	1.39 (0.79-2.45)	0.255
Age at study inclusion, yrs	0.99 (0.97-1.02)	0.569	1.01 (0.97-1.05)	0.586	0.99 (0.96-1.02)	0.450	-		-	-
<18	1		1		1		-		-	-
≥18	0.63 (0.86-2.89)	0.139	0.81 (0.46-3.35)	0.674	0.62 (0.75-3.53)	0.222	-		-	-

IE, infective endocarditis; PVR, pulmonary valve replacement; n.a., not applicable; HR, hazard ratio; CI, confidence interval. *PVR size was known in 1247/1598 PVR

Table S5. Sex and age-specific impact factors on the occurrence of IE in multivariable Cox-regression

All types of PVR	Female sex*		Male sex		Patients <18 years at study inclusion		Patients ≥18 years at study inclusion*	
	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value
Type of PVR								
Homograft	1		1		1		1	
Heterograft excluding Contegra	2.18 (0.14-35.12)	0.584	2.51 (0.80-7.87)	0.116	2.92 (0.82-10.37)	0.098	1.23 (0.13-11.89)	0.858
Contegra	24.39 (2.84-209.54)	0.004	4.55 (1.71-12.15)	0.003	5.54 (1.89-16.23)	0.002	8.13 (1.64-40.33)	0.010
Melody	24.30 (2.71-217.64)	0.004	3.22 (1.08-9.62)	0.036	3.60 (1.08-12.05)	0.038	16.30 (3.37-78.80)	<0.001
Sex								
Female	-		-		1		1	
Male	-		-		1.90 (0.95-3.80)	0.069	1.67 (0.57-4.85)	0.350
Number of previous PVR	1.10 (0.58-2.07)	0.773	1.61 (1.11-2.36)	0.013	1.70 (1.16-2.48)	0.006	0.76 (0.34-1.73)	0.517
Age at study inclusion, yrs	1.05 (1.01-1.09)	0.025	1.00 (0.98-1.04)	0.662	-			
Subgroup with Contegra or Melody								
Type of PVR								
Contegra	1		1		1		1	
Melody	1.09 (0.29-4.13)	0.904	0.97 (0.33-2.83)	0.952	0.90 (0.35-2.31)	0.822	2.01 (0.39-10.35)	0.404
Sex								
Female	-		-		1		1	
Male	-		-		1.23 (0.59-2.56)	0.586	1.98 (0.55-7.10)	0.297
Number of previous PVR	1.20 (0.64-2.27)	0.565	1.49 (0.90-2.48)	0.126	1.54 (0.97-2.45)	0.068	0.98 (0.43-2.22)	0.952
Age at study inclusion, yrs	1.04 (0.98-1.09)	0.178	1.01 (0.98-1.05)	0.524	-		-	

IE, infective endocarditis; PVR, pulmonary valve replacement; HR, hazard ratio; CI, confidence interval.

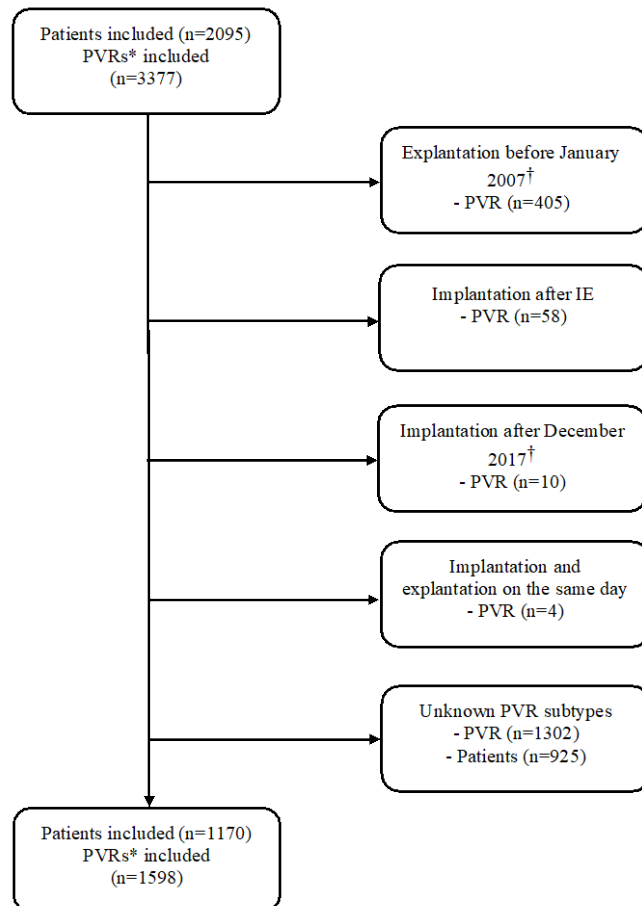
*For female sex (17 IE) and for patients ≥ 18 years (14 IE) the model was with four covariables potentially overspecified.

Table S6. Characteristics of patients with IE after PVR according to sex and age at study inclusion

	Total	Sex		Age at study inclusion, y	
		Males	Females	<18	≥18
Patients with IE, N					
Total	56	39	17	42	14
Melody	18	11	7	11	7
SPVR	38	28	10	31	7
Heterograft excluding Contegra	7	6	1	6	1
Contegra	24	16	8	21	3
Homograft	7	6	1	4	3
Number of previous PVR*					
Total	0 (0-2)	1 (0-2)	1 (0-1)	1 (0-2)	0.5 (0-1)
Melody	1 (1-2)	1 (1-2)	1 (1-3)	2 (1-2)	1 (1-2)
Heterograft excluding Contegra	0 (0-1)	1 (0-2)	0 (0-0)	1 (0-2)	0 (0-0)
Contegra	0 (0-1)	0.5 (0-1)	0 (0-1)	0 (0-1)	0 (0-0)
Homograft	0 (0-2)	0 (0-2.5)	0 (0-0)	1 (0-3.5)	0 (0-0)
Patient-Years of Follow-Up					
Total†	274	188	86	209	65
PPVI‡					
Melody‡	73	37	36	47	26
SPVR‡	134	89	45	110	24
Heterograft‡ excluding Contegra	46	37	9	37	9
Contegra	75	44	31	72	3
Homograft‡	13	8	5	1	12

*Median (interquartile range), †calculated based on the number of patients, ‡ calculated based on the number of PVR.

Figure S1. Study flow chart.



Study design for the recruitment of patients with PVR in the National Register for Congenital Heart Defects, Berlin, Germany. *Number of PVR in the patients. †Cases of pulmonary-valve-related IE were recorded during the period of January 1st, 2007 until December 31st, 2017. PVR, pulmonary valve replacement; IE, infective endocarditis; CHD, congenital heart defect.