

SUPPLEMENTARY MATERIAL

Heart Failure with Preserved and Reduced Ejection Fraction in Hemodialysis Patients: Prevalence, Disease Prediction and Prognosis

Marlies Antlanger^a Stefan Aschauer^b Chantal Kopecky^a Manfred Hecking^a
Johannes J. Kovarik^a Johannes Werzowa^{a,c} Julia Mascherbauer^b Bernd Genser^{d,e}
Marcus D. Säemann^{a,f} Diana Bonderman^b

^aDepartment of Internal Medicine III, Division of Nephrology and Dialysis; ^bDepartment of Internal Medicine II, Division of Cardiology, Medical University of Vienna; ^cDepartment of Internal Medicine I, Division of Nephrology, Hanusch Hospital, Vienna, Austria; ^dMannheim Institute of Public Health, Social and Preventive Medicine, Medical Faculty Mannheim, Heidelberg University, Heidelberg, Germany; ^eInstitute of Public Health, Federal University of Bahia, Salvador, Brazil; ^fDepartment of Internal Medicine VI, Division of Nephrology, Wilhelminenspital, Vienna, Austria

SUPPLEMENTARY TABLE S1. Summary statistics of covariates stratified by tertiles (continuous variables) and frequency (categorical).

Age (years)	N	Mean	SD	Minimum	Maximum
Tertile 1	34	36.7	7.9	19	48
Tertile 2	36	56.4	4.7	49	65
Tertile 3	35	75.4	6.1	66	88
Total	105	56.3	17.0	19	88
BMI (kg/m²)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	21.8	1.7	18.1	24.1
Tertile 2	35	25.6	0.7	24.3	26.8
Tertile 3	35	30.5	4.3	26.9	49.2
Total	105	26.0	4.5	18.1	49.2
RRsys Start (mmHg)	N	Mean	SD	Minimum	Maximum
Tertile 1	33	115	11	82	130
Tertile 2	35	137	4	131	144
Tertile 3	37	163	15	145	202
Total	105	139	22	82	202
Hemoglobin (g/dL)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	8.9	0.8	6.1	9.9
Tertile 2	35	10.5	0.3	10	11.1
Tertile 3	35	11.8	0.5	11.2	12.8
Total	105	10.4	1.3	6.1	12.8
NT pro-BNP (pg/ml)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	1,896.3	581.4	1,027	3,311
Tertile 2	35	7,389.0	3,047.8	3,334	12,229.3
Tertile 3	35	27,402.8	8,573.8	12,726	35,000
Total	105	12,229.3	12,185.3	1,027	35,000
OHpost (% ECW)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	-11.6	6.9	-34.7	-1.9
Tertile 2	35	0.9	1.6	-1.3	5
Tertile 3	35	13.1	6.4	5.8	31.8
Total	105	0.8	11.5	-34.7	31.8
LTM (kg)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	28.7	3.7	21.4	34
Tertile 2	35	40.1	2.6	34.7	44.3
Tertile 3	35	54.4	7.1	44.8	69.3
Total	105	41.1	11.6	21.4	69.3
ATM (kg)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	15.5	5.5	5.3	23.8
Tertile 2	35	30.9	3.4	23.9	35.9
Tertile 3	35	47.6	10.9	36.3	84.8
Total	105	31.4	15.0	5.3	84.8
HD vintage (years)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	0.8	0.3	0.3	1.3
Tertile 2	35	2.7	0.8	1.5	3.7
Tertile 3	35	8.8	6.9	3.8	36.6
Total	105	4.1	5.3	0.3	36.6
IVS (mm)	N	Mean	SD	Minimum	Maximum
Tertile 1	23	11.0	1.1	9	12
Tertile 2	33	13.7	0.6	13	15
Tertile 3	49	17.0	2.1	15	24
Total	105	14.7	2.9	9	24
LA (mm)	N	Mean	SD	Minimum	Maximum
Tertile 1	35	48.6	3.5	40	53

Tertile 2	31	56.5	1.8	54	59
Tertile 3	39	65.9	6.4	60	92
Total	105	57.4	8.5	40	92
sPAP (mmHg)	N	Mean	SD	Minimum	Maximum
Tertile 1	21	33.7	3.5	28	41
Tertile 3	84	44.1	5.8	42	70
Total	105	42.0	6.9	28	70
E/E' ratio	N	Mean	SD	Minimum	Maximum
Tertile 1	28	9.5	2.6	4	14
Tertile 3	77	15.9	4.5	14.2	36
Total	105	14.2	5.0	4	36
Sex		N		%	
Female		38		36.2	
Male		67		64.8	
Hypertension		N		%	
No		18		17.1	
Yes		87		82.9	
Atrial fibrillation		N		%	
No		89		84.8	
Yes		16		15.2	
CAD		N		%	
No		77		73.3	
Yes		28		26.7	
DM		N		%	
No		84		80	
Yes		21		20	
Diastolic dysfunction grade		N		%	
0/1		70		66.7	
2		19		18.1	
3/4		16		15.2	

BMI, body mass index; RRsys, systolic blood pressure; BNP, brain natriuretic peptide; OHpost, postdialytic overhydration; ECW, extracellular water; LTM, lean tissue mass; ATM, adipose tissue mass; IVS, interventricular septum; LA, left atrial diameter; sPAP, systolic pulmonary artery pressure; E, early medial diastolic mitral velocity, E', early lateral diastolic mitral velocity; CAD, coronary artery disease; DM, diabetes mellitus.

SUPPLEMENTARY TABLE S2. Analysis of factors associated with HFpEF by univariate logistic regression analysis (continuous model).

Variable	P-Value	OR	CI (95%)
Age	<0.001	1.06	1.03-1.10
BMI	0.003	1.26	1.08-1.47
RRsys Start	0.218	1.01	0.99-1.04
Hb	0.121	0.74	0.50-1.08
NT pro-BNP	0.074	1.00	0.99-1.00
OHpost	0.931	0.99	0.96-1.04
LTM	0.063	0.96	0.93-1.00
ATM	0.005	1.05	1.02-1.09
HD vintage	0.866	0.99	0.91-1.08
IVS	0.366	1.08	0.92-1.23
LA	0.031	1.08	1.01-1.16
sPAP	0.712	1.02	0.93-1.12
E/E' medial	0.013	1.21	1.04-1.40
Sex (female)	0.155	2.07	0.76-5.61
HTN (yes)	0.189	2.17	0.68-6.92
Atrial fibrillation (yes)	0.421	1.96	0.38-10.09
CAD (yes)	0.047	3.83	1.02-14.33
DM (yes)	0.171	2.32	0.69-7.76

BMI, body mass index; RRsys, systolic blood pressure; BNP, brain natriuretic peptide; OHpost, postdialytic overhydration; ECW, extracellular water; LTM, lean tissue mass; ATM, adipose tissue mass; IVS, interventricular septum; LA, left atrial diameter; sPAP, systolic pulmonary artery pressure; E, early medial diastolic mitral velocity, E', early lateral diastolic mitral velocity; CAD, coronary artery disease; DM, diabetes mellitus.

SUPPLEMENTARY TABLE S3. Analysis of factors associated with HFpEF by univariate logistic regression analysis (tertile model).

Variable	P-Value	OR	CI 95%
Age			
Tertile 2 vs. 1	0.020	3.56	1.22-10.36
Tertile 3 vs. 1	0.001	9.95	2.48-39.95
BMI			
Tertile 2 vs. 1	0.102	2.44	0.84-7.14
Tertile 3 vs. 1	0.057	3.00	0.97-9.30
RRsys Start			
Tertile 2 vs. 1	0.494	1.49	0.49-4.42
Tertile 3 vs. 1	0.240	1.97	0.64-6.08
Hemoglobin			
Tertile 2 vs. 1	0.049	0.30	0.09-0.99
Tertile 3 vs. 1	0.027	0.26	0.08-0.86
NT pro-BNP			
Tertile 2 vs. 1	0.221	1.94	0.67-5.64
Tertile 3 vs. 1	0.090	2.63	0.86-8.02
OHpost			
Tertile 2 vs. 1	0.349	0.58	0.19-1.80
Tertile 3 vs. 1	0.438	0.64	0.20-1.99
LTM			
Tertile 2 vs. 1	0.080	0.31	0.08-1.15
Tertile 3 vs. 1	0.023	0.23	0.06-0.81
ATM			
Tertile 2 vs. 1	0.021	3.60	1.22-10.64
Tertile 3 vs. 1	0.005	5.75	1.72-19.30
HD vintage			
Tertile 2 vs. 1	0.002	0.15	0.04-0.51
Tertile 3 vs. 1	0.164	0.42	0.12-1.42
IVS			
Tertile 2 vs. 1	0.174	2.34	0.69-7.94
Tertile 3 vs. 1	0.223	1.96	0.67-5.77
LA			
Tertile 2 vs. 1	0.039	3.33	1.06-10.48
Tertile 3 vs. 1	0.077	2.63	0.90-7.65
sPAP			
Tertile 3 vs. 1	0.908	0.94	0.31-2.81
E/E' ratio			
Tertile 3 vs. 1	0.075	2.35	0.92-6.02
Sex			
Male vs. female	0.155	0.48	0.18-1.32
HTN			
Yes vs. no	0.189	2.17	0.68-6.92
Atrial fibrillation			
Yes vs. no	0.421	1.96	0.38-10.09
CAD			
Yes vs. no	0.047	3.83	1.02-14.33
Diabetes mellitus			
Yes vs. no	0.171	2.32	0.69-7.76
Diastolic dysfunction			
Grade 2 vs. 0/1	0.574	1.37	0.46-4.09
Grade 3/4 vs. 0/1	NE	NE	NE

BMI, body mass index; RRsys, systolic blood pressure; BNP, brain natriuretic peptide; OHpost, postdialytic overhydration; ECW, extracellular water; LTM, lean tissue mass; ATM, adipose tissue mass; IVS, interventricular septum; LA, left atrial diameter; sPAP, systolic pulmonary artery pressure; E, early medial diastolic mitral velocity, E', early lateral diastolic mitral velocity; CAD, coronary artery disease; DM, diabetes mellitus, NE, not estimable since this category completely predicts HFPEF.

SUPPLEMENTARY TABLE S4. Analysis of factors associated with HFrEF by univariate logistic regression analysis (continuous model).

Variable	P-Value	OR	CI (95%)
Age	0.001	1.09	1.04-1.16
BMI	0.336	1.10	0.91-1.34
RRsys Start	0.435	0.99	0.96-1.02
Hb	0.170	0.69	0.40-1.17
NT pro-BNP	0.004	1.00	1.00-1.00
OHpost	0.891	1.00	0.94-1.07
LTM	0.020	0.91	0.84-0.99
ATM	0.102	1.04	0.99-1.10
HD vintage	0.423	0.91	0.73-1.14
IVS	0.538	1.07	0.86-1.33
LA	0.003	1.15	1.05-1.27
sPAP	0.016	1.17	1.03-1.33
E/E' medial	0.040	1.42	1.01-1.99
Sex (female)	0.314	2.05	0.51-8.34
HTN (yes)	0.609	0.68	0.16-2.92
Atrial fibrillation (yes)	0.002	16.33	2.69-99.00
CAD (yes)	0.004	10.50	2.09-52.85
DM (yes)	0.601	0.54	0.05-5.38

BMI, body mass index; RRsys, systolic blood pressure; BNP, brain natriuretic peptide; OHpost, postdialytic overhydration; ECW, extracellular water; LTM, lean tissue mass; ATM, adipose tissue mass; IVS, interventricular septum; LA, left atrial diameter; sPAP, systolic pulmonary artery pressure; E, early medial diastolic mitral velocity, E', early lateral diastolic mitral velocity; CAD, coronary artery disease; DM, diabetes mellitus.

SUPPLEMENTARY TABLE S5. Analysis of factors associated with HFREF by univariate logistic regression analysis (tertile model).

Variable	P-Value	OR	CI 95%
Age			
Tertile 2 vs. 1	0.035	11.88	1.19-118.50
Tertile 3 vs. 1	0.002	44.33	3.93-500.27
BMI			
Tertile 2 vs. 1	0.761	0.78	0.15-3.93
Tertile 3 vs. 1	0.717	1.33	0.28-6.33
RRsys Start			
Tertile 2 vs. 1	0.140	0.26	0.04-1.56
Tertile 3 vs. 1	0.559	0.63	0.14-2.91
Hemoglobin			
Tertile 2 vs. 1	0.290	0.42	0.08-2.11
Tertile 3 vs. 1	0.103	0.23	0.04-1.35
NT pro-BNP			
Tertile 2 vs. 1	0.081	7.78	0.78-77.93
Tertile 3 vs. 1	0.023	14.00	1.43-137.32
OHpost			
Tertile 2 vs. 1	0.354	0.47	0.09-2.34
Tertile 3 vs. 1	0.414	0.51	0.10-2.57
LTM			
Tertile 2 vs. 1	0.156	0.30	0.06-1.58
Tertile 3 vs. 1	0.015	0.09	0.13-0.62
ATM			
Tertile 2 vs. 1	0.362	2.13	0.42-10.75
Tertile 3 vs. 1	0.086	4.25	0.82-22.13
HD vintage			
Tertile 2 vs. 1	0.402	0.50	0.10-2.53
Tertile 3 vs. 1	0.297	0.38	0.59-2.37
IVS			
Tertile 2 vs. 1	0.292	2.86	0.41-20.14
Tertile 3 vs. 1	0.274	2.39	0.46-15.88
LA			
Tertile 2 vs. 1	0.538	1.07	0.86-1.33
Tertile 3 vs. 1	0.269	0.16	0.01-4.09
sPAP			
Tertile 3 vs. 1	0.334	3.00	0.32-27.83
E/E' ratio			
Tertile 3 vs. 1	0.045	9.18	1.05-79.90
Sex			
Male vs. female	0.314	0.49	0.12-1.98
HTN			
Yes vs. no	0.609	0.69	0.16-2.92
Atrial fibrillation			
Yes vs. no	0.002	16.33	2.70-99.00
CAD			
Yes vs. no	0.004	10.50	2.09-52.85
Diabetes mellitus			
Yes vs. no	0.601	0.54	0.55-5.38
Diastolic dysfunction			
Grade 2 vs. 0/1	NE	NE	NE
Grade 3/4 vs. 0/1	NE	NE	NE

BMI, body mass index; RRsys, systolic blood pressure; BNP, brain natriuretic peptide; OHpost, postdialytic overhydration; ECW, extracellular water; LTM, lean tissue mass; ATM, adipose tissue mass; IVS, interventricular septum; LA, left atrial diameter; sPAP, systolic pulmonary artery pressure; E, early medial diastolic mitral velocity, E', early lateral diastolic mitral velocity; CAD, coronary artery disease; DM, diabetes mellitus, NE, not estimable since this category completely predicts HFREF.