

Supplement S1

Correlations of left atrial strain

I. Correlations between left atrial *strain* measures and volumetric, hemodynamic and functional parameters – total cohort

Interpretation of $|r|$ or $|p|$ according to Cohen

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, N.J.: L. Erlbaum Associates.

small effect size	$ r $ or $ p = .10$
medium effect size	$ r $ or $ p = .30$
large effect size	$ r $ or $ p = .50$

Calculation according to Hemmerich, W. (2019). StatistikGuru: Poweranalyse und Stichprobenberechnung für Regression.

Retrieved from <https://statistikguru.de/rechner/poweranalyse-regression.html>

<i>Total (N = 183)</i>	<i>LA-S_{res}</i>	<i>LA-S_{con}</i>	<i>LA-S_{boo}</i>
HR	0.150 [§]	0.214*	-0.039
LA-EF_{tot}	0.273*	0.310*	0.085
LV-EF	0.024	-0.045	0.162 [§]
LV-GLS	-0.068	-0.015	-0.122
LV-GCS	-0.084	-0.006	-0.148 [§]
LV-GRS	0.080	0.000	0.154 [§]
S/D	-0.046	-0.204*	0.301*
E/A	0.061	0.220*	-0.267*
E	0.245*	0.340*	-0.068
A	0.052	-0.068	0.241*
E/e'	0.103	0.080	0.048
e'	0.023	0.096	-0.080
MAPSE	0.105	0.148 [§]	-0.025
SI	-0.084	-0.014	-0.120
Age	-0.096	-0.294*	0.313*
MM_i	-0.314*	-0.267*	-0.216*

*Statistically significant ($p < 0.01$, two-sided).

[§]Statistically significant ($p < 0.05$, two-sided).

LA-S_{res}, reservoir left atrial strain; LA-S_{con}, conduit left atrial strain; LA-S_{boo}, booster left atrial strain; HR, heart rate; LA-EF_{total}, total left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; $\dot{e}$, mean lateral and septal cine CMR velocities; E/ $\dot{e}$, ratio E-wave to $\dot{e}$; MAPSE, Mitral annulus plain systolic excursion; SI, Sphericity index; MM_i, BSA-indexed muscle-mass.

II. Correlations between left atrial *strain rates* and volumetric, hemodynamic and functional parameters – total cohort

Total (N = 183)	LA-SR_{res}	LA-SR_{con}	LA-SR_{boo}
HR	0.251*	-0.241*	-0.378*
LA-EF_{tot}	0.261*	-0.268*	-0.152 [§]
LV-EF	0.007	0.020	-0.133
LV-GLS	-0.029	0.025	0.194*
LV-GCS	-0.038	0.053	0.267*
LV-GRS	0.040	-0.050	-0.274*
S/D	-0.118	0.215*	-0.266*
E/A	0.098	-0.171 [§]	0.283*
E	0.261*	-0.355*	-0.019
A	0.017	-0.001	-0.329*
E/e'	0.152 [§]	-0.098	-0.087
e'	-0.018	-0.084	0.064
MAPSE	0.092	-0.035	0.088
SI	0.021	0.048	0.026
Age	-0.164 [§]	0.308*	-0.231*
MM_i	-0.233*	0.283*	-0.291*

*Statistically significant (p < 0.01, two-sided).

[§]Statistically significant (p < 0.05, two-sided).

LA-SR_{res}, reservoir left atrial strain rate; LA-SR_{con}, conduit left atrial strain rate; LA-SR_{boo}, booster left atrial strain rate; HR, heart rate; LA-EF_{total}, total left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; e', mean lateral and septal cine CMR velocities; E/e', ratio E-wave to e'; MAPSE, Mitral annulus plane systolic excursion; SI, Sphericity index; MM_i, BSA-indexed muscle-mass.

III. Correlations between left atrial *strain* measures and volumetric, hemodynamic and functional parameters – male subjects, total cohort

<i>Male (N = 86)</i>	LA-S _{res}	LA-S _{con}	LA-S _{boo}
HR	0.237 [§]	0.296*	-0.028
LA-Vol _{max_i}	-0.261 [§]	-0.289*	-0.017
LA-Vol _{min_i}	-0.325*	-0.364*	-0.022
LA-Vol _{boo_i}	-0.288*	-0.350*	0.053
LA-EF _{tot}	0.332*	0.351*	0.094
LA-EF _{con}	0.193	0.306*	-0.164
LA-EF _{boo}	0.211	0.105	0.288*
LV-EF	0.173	0.083	0.278*
LV-GLS	-0.115	-0.057	-0.172
LV-GCS	-0.222 [§]	-0.200	-0.122
LV-GRS	0.221 [§]	0.199	0.123
S/D	-0.084	-0.227 [§]	0.283*
E/A	0.050	0.142	-0.193
E	0.235 [§]	0.293*	-0.034
A	0.088	0.023	0.209
E/e'	0.039	0.035	0.037
e'	0.094	0.139	-0.048
MAPSE	0.084	0.153	-0.075
SI	-0.077	-0.013	-0.184
BMI	-0.064	-0.087	-0.014
LV-EDV _i	-0.106	-0.008	-0.173
LV-ESV _i	-0.184	-0.052	-0.326*
LV-SV _i	0.018	0.050	0.007
Age	-0.049	-0.193	0.271 [§]
MM _i	-0.210	-0.134	-0.147

*Statistically significant (p < 0.01, two-sided).

§Statistically significant (p < 0.05, two-sided).

LA-S_{res}, reservoir left atrial strain; LA-S_{con}, conduit left atrial strain; LA-S_{boo}, booster left atrial strain; HR, heart rate; LA-Vol_{max_i}, indexed maximum left atrial volume; LA-Vol_{min_i}, indexed minimum left atrial volume; LA-Vol_{boo_i}, indexed booster left atrial volume; LA-EF_{tot}, total left atrial ejection fraction; LA-EF_{con}, passive left atrial ejection fraction; LA-EF_{boo}, booster left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; e', mean lateral and septal cine CMR velocities; E/e', ratio E-wave to e'; MAPSE, Mitral annulus plane systolic excursion; SI, Sphericity index; BMI, body mass index; MM_i, BSA-indexed muscle-mass; LV-EDV_i, indexed left ventricular end diastolic volume; LV-ESV_i, indexed left ventricular end systolic volume; LV-SV_i, indexed left ventricular stroke volume.

IV. Correlations between left atrial *strain* measures and volumetric, hemodynamic and functional parameters – female subjects, total cohort

<i>Female (N = 97)</i>	LA-S _{res}	LA-S _{con}	LA-S _{boo}
HR	0.023	0.089	-0.105
LA-Vol _{max_i}	-0.095	-0.191	0.140
LA-Vol _{min_i}	-0.147	-0.250 [§]	0.104
LA-Vol _{boo_i}	-0.115	-0.303*	0.283*
LA-EF _{tot}	0.161	0.214 [§]	0.024
LA-EF _{con}	0.115	0.340*	-0.322*
LA-EF _{boo}	0.125	-0.075	0.427*
LV-EF	0.235 [§]	-0.268*	0.005
LV-GLS	0.177	0.220 [§]	0.020
LV-GCS	0.273*	0.389*	-0.059
LV-GRS	-0.272*	-0.397*	0.063
S/D	-0.004	-0.181	0.333*
E/A	0.034	0.246 [§]	-0.356*
E	0.125	0.253 [§]	-0.209 [§]
A	0.016	-0.154	0.269*
E/e'	0.106	0.048	0.050
e'	-0.051	0.062	-0.135
MAPSE	0.154	0.196	0.047
SI	-0.073	-0.011	-0.043
BMI	0.116	-0.037	0.324*
LV-EDV _i	0.024	0.129	-0.187
LV-ESV _i	0.214 [§]	0.301*	-0.086
LV-SV _i	-0.140	-0.101	-0.128
Age ⁺	-0.146	-0.381*	0.364*
MM _i ⁺	-0.160	-0.117	-0.170

*Statistically significant (p < 0.01, two-sided).

§Statistically significant (p < 0.05, two-sided).

LA-S_{res}, reservoir left atrial strain; LA-S_{con}, conduit left atrial strain; LA-S_{boo}, booster left atrial strain; HR, heart rate; LA-Vol_{max_i}, indexed maximum left atrial volume; LA-Vol_{min_i}, indexed minimum left atrial volume; LA-Vol_{boo_i}, indexed booster left atrial volume; LA-EF_{tot}, total left atrial ejection fraction; LA-EF_{con}, passive left atrial ejection fraction; LA-EF_{boo}, booster left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; e', mean lateral and septal cine CMR velocities; E/e', ratio E-wave to e'; MAPSE, Mitral annulus plain systolic excursion; SI, Sphericity index; BMI, body mass index; MM_i, BSA-indexed muscle-mass; LV-EDV_i, indexed left ventricular end diastolic volume; LV-ESV_i, indexed left ventricular end systolic volume; LV-SV_i, indexed left ventricular stroke volume.

V. Correlations between left atrial *strain rates* and volumetric, hemodynamic and functional parameters – male subjects, total cohort

<i>Male (N = 86)</i>	LA-SR _{res}	LA-SR _{con}	LA-SR _{boo}
HR	0.329*	-0.378*	-0.456*
LA-Vol _{max_i}	-0.305*	0.425*	0.198
LA-Vol _{min_i}	-0.372*	0.428*	0.223 [§]
LA-Vol _{boo_i}	-0.328*	0.459*	0.171
LA-EF _{tot}	0.336*	-0.332*	-0.220 [§]
LA-EF _{con}	0.233 [§]	-0.330*	-0.036
LA-EF _{boo}	0.190	-0.048	-0.225 [§]
LV-EF	0.121	-0.085	-0.222 [§]
LV-GLS	-0.167	0.194	0.262 [§]
LV-GCS	-0.222 [§]	0.255 [§]	0.354*
LV-GRS	0.235 [§]	-0.254 [§]	-0.370*
S/D	-0.188	0.263 [§]	-0.167
E/A	0.085	-0.115	0.203
E	0.251 [§]	-0.404*	-0.133
A	0.049	-0.094	-0.339*
E/e'	0.110	-0.027	-0.037
e'	0.017	-0.171	-0.031
MAPSE	0.115	-0.038	0.028
SI	0.029	0.043	0.040
BMI	-0.106	0.177	0.031
LV-EDV _i	-0.104	0.015	0.252 [§]
LV-ESV _i	-0.159	0.058	0.329*
LV-SV _i	-0.021	-0.011	0.097
Age	-0.111	0.259 [§]	-0.134
MM _i	-0.205	0.239 [§]	0.226 [§]

*Statistically significant (p < 0.01, two-sided).

[§]Statistically significant (p < 0.05, two-sided).

LA-SR_{res}, reservoir left atrial strain rate; LA-SR_{con}, conduit left atrial strain rate; LA-SR_{boo}, booster left atrial strain rate; HR, heart rate; LA-Vol_{max_i}, indexed maximum left atrial volume; LA-Vol_{min_i}, indexed minimum left atrial volume; LA-Vol_{boo_i}, indexed booster left atrial volume; LA-EF_{total}, total left atrial ejection fraction; LA-EF_{con}, passive left atrial ejection fraction; LA-EF_{boo}, booster left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; e', mean lateral and septal cine CMR velocities; E/e', ratio E-wave to e'; MAPSE, Mitral annulus plain systolic excursion; SI, Sphericity index; BMI, body mass index; MM_i, BSA-indexed muscle-mass; LV-EDV_i, indexed left ventricular end diastolic volume; LV-ESV_i, indexed left ventricular end systolic volume; LV-SV_i, indexed left ventricular stroke volume.

VI. Correlations between left atrial *strain rates* and volumetric, hemodynamic and functional parameters – female subjects, total cohort

<i>Female (N = 97)</i>	LA-SR _{res}	LA-SR _{con}	LA-SR _{boo}
HR	0.153	-0.086	-0.299*
LA-Vol _{max_i}	-0.077	0.308*	0.007
LA-Vol _{min_i}	-0.124	-0.304*	0.034
LA-Vol _{boo_i}	-0.173	0.365*	-0.104
LA-EF _{tot}	0.158	-0.174	-0.048
LA-EF _{con}	0.206 [§]	-0.290*	0.206 [§]
LA-EF _{boo}	-0.016	0.079	-0.340*
LV-EF	-0.144	0.195	0.015
LV-GLS	0.199	-0.230 [§]	0.054
LV-GCS	0.244 [§]	-0.263*	0.120
LV-GRS	-0.253 [§]	0.276*	-0.111
S/D	-0.058	0.181	-0.366*
E/A	0.074	-0.221 [§]	0.379*
E	0.189	-0.243 [§]	0.186
A	-0.003	0.096	-0.307*
E/e'	0.149	-0.102	-0.069
e'	-0.057	-0.015	0.136
MAPSE	0.111	-0.072	0.109
SI	0.027	0.044	-0.006
BMI	-0.018	0.067	-0.280*
LV-EDV _i	0.008	-0.025	0.310*
LV-ESV _i	0.127	-0.166	0.139
LV-SV _i	-0.130	0.136	0.270*
Age	-0.201 [§]	0.368*	-0.316*
MM _i	-0.100	0.192	0.274*

*Statistically significant (p < 0.01, two-sided).

[§]Statistically significant (p < 0.05, two-sided).

LA-SR_{res}, reservoir left atrial strain rate; LA-SR_{con}, conduit left atrial strain rate; LA-SR_{boo}, booster left atrial strain rate; HR, heart rate; LA-Vol_{max_i}, indexed maximum left atrial volume; LA-Vol_{min_i}, indexed minimum left atrial volume; LA-Vol_{boo_i}, indexed booster left atrial volume; LA-EF_{total}, total left atrial ejection fraction; LA-EF_{con}, passive left atrial ejection fraction; LA-EF_{boo}, booster left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; $\dot{e}$, mean lateral and septal cine CMR velocities; E/ $\dot{e}$, ratio E-wave to $\dot{e}$; MAPSE, Mitral annulus plain systolic excursion; SI, Sphericity index; BMI, body mass index; MM_i, BSA-indexed muscle-mass; LV-EDV_i, indexed left ventricular end diastolic volume; LV-ESV_i, indexed left ventricular end systolic volume; LV-SV_i, indexed left ventricular stroke volume.

Supplement S2

Table S2a: Multilinear regression analysis to study multifactorial influences of left atrial strain. Analysis was done on the total female study group (N = 97) using all heart rates.

	Validity*	Parameter	R	R ²	corr R ²	ANOVA significance	Sample size [†]	Goodness-of-fit	Function
reservoir	1	LA-S _{res} LA-Vol _{min_ij} , LA-EF _{tot} , LV-GCS E	-	-	-	-	-	-	-
	2	LA-S _{res} E, LV-GCS LA-EF _{tot}	0.398	0.158	0.131	0.001	80	medium	LA-S _{res} = 0.659 * LA-EF _{tot} + 1.946 * LV-GCS + 0.152 * E + 44.010
	3	LA-S _{res} LV-GRS, LV-EF, LA-EF _{tot} , MMi	0.380	0.144	0.106	0.007	97	medium	LA-S _{res} = -0.627 * LV-GRS - 0.066 * LV-EF + 0.548 * LA-EF _{tot} - 0.285 * MMi + 61.163
	3a	LA-S _{res} LV-GRS LA-EF _{tot}	0.348	0.121	0.102	0.003	95	small	LA-S _{res} = -0.606 * LV-GRS + 0.623 * LA-EF _{tot} + 37.537

conduit	4	LA-S _{con}	LA-Vol _{boo_i} , LA-EF _{tot} , LV-GRS E	0.515	0.265	0.233	< 0.001	48	large	LA-S _{con} = -0.144 * LA-V _{boo_i} + 0.463 * LA-EF _{tot} - 0.613 * LV-GRS + 0.270 * E + 18.627
	5	LA-S _{con}	LA-Vol _{min_i} , LV-GCS, E, S/D	0.520	0.270	0.238	<0.001	47	large	LA-S _{con} = -0.656 * LA-V _{min_i} + 2.233 * LV-GCS + 0.376 * E + 5.141 * S/D + 64.121
	6	LA-S _{con}	LA-EF _{con} , LV-GCS, age LV-ESV _i	0.498	0.248	0.215	<0.001	52	medium	LA-S _{con} = 0.308 * LA-EF _{con} + 1.528 * LV-GCS - 0.160 * age - 0.137 * LV-ESV _i + 61.851
	6a	LA-S _{con}	LV-GCS, LA-Vol _{min_i} E	0.500	0.250	0.226	<0.001	47	medium	LA-S _{con} = 1.954 * LV-GCS - 0.503 * LA-V _{min_i} + 0.316 * E + 64.522
booster	7	LA-S _{boo}	LA-EF _{boo} , LV-EF, A S/D	0.569	0.324	0.293	< 0.001	38	large	LA-S _{boo} = 0.282 * LA-EF _{boo} - 0.293 * LV-EF - 0.022 * A + 4.194 * S/D + 23.432
	8	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i , age A	0.553	0.306	0.275	<0.001	41	large	LA-S _{boo} = 0.315 * LA-EF _{boo} + 0.307 * LV-ESV _i + 0.100 * age + 0.008 * A - 4.055
	9	LA-S _{boo}	LA-Vol _{boo_i} , LA-EF _{boo} , MM _i BMI	0.492	0.242	0.208	<0.001	54	medium	LA-S _{boo} = 0.111 * LA-V _{boo_i} + 0.217 * LA- EF _{boo} - 0.079 * MM _i + 0.175 * BMI + 6.784
	10	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i A	0.490	0.240	0.215	<0.001	49	medium	LA-S _{boo} = 0.320 * LA-EF _{boo} + 0.209 * LV-ESV _i + 0.082 * A - 0.628

reservoir	1	LA-SR _{res}	LA_Vol _{min_i} , LV-GRS; E age	0.340	0.116	0.076	0.024	123	small	LA-SR _{res} = -0.020 * LA_V _{min_i} - 0.024 * LV-GRS + 0.012 * E - 0.005 * age + 3.131
	2	LA-SR _{res}	LA_Vol _{min_i} E	0.256	0.066	0.046	0.042	183	small	LA-SR _{res} = -0.027 * LA_V _{min_i} + 0.016 * E + 1.997
conduit	3	LA-SR _{con}	LA_Vol _{boo_i} , LA-EF _{tot} , S/D E	0.448	0.201	0.165	0.001	67	medium	LA-SR _{con} = 0.069 * LA_V _{boo_i} - 0.007 * LA-EF _{tot} - 0.467 * S/D - 0.039 * E - 2.360
	4	LA-SR _{con}	LA-EF _{con} , LV-GRS, MM _i age	0.540	0.292	0.259	<0.001	43	large	LA-SR _{con} = -0.035 * LA-EF _{con} + 0.048 * LV-GRS + 0.057 * MM _i + 0.016 * age - 7.405
	5	LA-SR _{con}	LA_Vol _{boo_i} E	0.438	0.192	0.174	<0.001	57	medium	LA-SR _{con} = 0.059 * LA_V _{boo_i} - 0.037 * E - 3.099
booster	6	LA-SR _{boo}	LA-EF _{boo} , LV-GCS, S/D A	0.441	0.195	0.159	0.001	69	medium	LA-SR _{boo} = -0.030 * LA-EF _{boo} - 0.021 * LV-GCS - 0.488 * S/D - 0.016 * A - 0.875
	7	LA-SR _{boo}	LA-EF _{boo} , A, LV-EDV _i MM _i	0.441	0.195	0.159	0.001	69	medium	LA-SR _{boo} = -0.017 * LA-EF _{boo} - 0.026 * A - 0.004 * LV-EDV _i + 0.036 * MM _i - 2.626

* green = valid; orange = valid, but with fewer concerns due to the prerequisites; red = not valid due to violation of prerequisites.

Interpretation of |R²| according to Cohen. [Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, N.J.: L. Erlbaum Associates. Page 412 ff].

small effect size: |R²| = .02; medium effect size |R²| = .13; large effect size |R²| = .26.

† Sample size calculation see reference [Calculation according to Hemmerich, W. (2019). StatistikGuru: Poweranalyse und Stichprobenberechnung für Regression. Retrieved from

<https://statistikguru.de/rechner/poweranalyse-regression.html>].

LA-S_{res}, reservoir left atrial strain; LA-S_{con}, conduit left atrial strain; LA-S_{boo}, booster left atrial strain; LA-SR_{res}, reservoir left atrial strain rate; LA-SR_{con}, conduit left atrial strain rate; LA-SR_{boo}, booster left atrial strain rate; LA-Vol_{max_i}, indexed maximum left atrial volume; LA-Vol_{min_i}, indexed minimum left atrial volume; LA-Vol_{boo_i}, indexed booster left atrial volume; LA-EF_{total}, total left atrial ejection fraction; LA-EF_{con}, passive left atrial ejection fraction; LA-EF_{boo}, booster left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; $\dot{e}$, mean lateral and septal cine CMR velocities; E/ $\dot{e}$, ratio E-wave to $\dot{e}$; MAPSE, Mitral annulus plain systolic excursion; SI, Sphericity index; MM_i, BSA-indexed muscle-mass; LV-EDV_i, indexed left ventricular end diastolic volume; LV-ESV_i, indexed left ventricular end systolic volume; LV-SV_i, indexed left ventricular stroke volume.

Table S2b: Multilinear regression analysis to study multifactorial influences of left atrial strain. Analysis was done on the total male study group (N = 86) using all heart rates.

	validity		Parameter	R	R ²	corr R ²	ANOVA significance	Sample size [†]	Goodness-of-fit	Function
reservoir	1	LA-S _{res}	LA-Vol _{min_i} , LA-EF _{tot} , LV-GCS E	0.463	0.215	0.172	<0.001	62	medium	LA-S _{res} = -0.262 * LA-V _{min_i} + 0.302 * LA-EF _{tot} - 0.842 * LV-GCS + 0.182 * E + 7.836
	2	LA-S _{res}	E, LV-GCS LA-EF _{tot}	0.452	0.205	0.172	0.001	60	medium	LA-S _{res} = 0.521 * LA-EF _{tot} - 0.891 * LV-GCS + 0.187 * E - 11.379
	3	LA-S _{res}	LV-GRS, LV-EF, LA-EF _{tot} , MM _i	0.428	0.183	0.138	0.005	74	medium	LA-S _{res} = 0.273 * LV-GRS + 0.100 * LV-EF + 0.594 * LA-EF _{tot} - 0.088 * MM _i + 1.172

conduit	4	LA-S _{con}	LA-Vol _{boo_i} , LA-EF _{tot} , LV-GRS E	0.474	0.225	0.181	0.001	59	medium	LA-S _{con} = -0.124 * LA-V _{boo_i} + 0.418 * LA-EF _{tot} + 0.064 * LV-GRS + 0.175 * E – 2.450
	5	LA-S _{con}	LA-Vol _{min_i} , LV-GCS, E, S/D	0.451	0.203	0.160	0.002	66	medium	LA-S _{con} = -0.383 * LA-V _{min_i} - 0.404 * LV-GCS + 0.204 * E - 0.535 * S/D + 18.604
	6	LA-S _{con}	LA-EF _{con} , LV-GCS, age LV-ESV _i	0.415	0.173	0.127	0.008	79	medium	LA-S _{con} = 0.470 * LA-EF _{con} - 0.771 * LV-GCS + 0.026 * age + 0.046 * LV-ESV _i – 3.145
booster	7	LA-S _{boo}	LA-EF _{boo} , LV-EF, A S/D	0.395	0.156	0.111	0.011	89	medium	LA-S _{boo} = 0.156 * LA-EF _{boo} + 0.195 * LV-EF + 0.044 * A + 1.908 * S/D – 5.230
	8	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i , age A	0.447	0.200	0.156	0.002	67	medium	LA-S _{boo} = 0.106 * LA-EF _{boo} - 0.292 * LV-ESV _i + 0.025 * age + 0.039 * A + 18.547
	9	LA-S _{boo}	LA-Vol _{boo_i} , LA-EF _{boo} , MM _i BMI	0.341	0.116	0.069	0.054	123	small	LA-S _{boo} = 0.061 * LA-V _{boo_i} + 0.180 * LA-EF _{boo} - 0.158 * MM _i - 0.139 * BMI + 21.047
	10	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i A	0.442	0.195	0.163	0.001	63	medium	LA-S _{boo} = 0.111 * LA-EF _{boo} - 0.296 * LV-ESV _i + 0.066 * A + 18.592

reservoir	1	LA-SR _{res}	LA_Vol _{min_i} , LV-GRS; E age	0.557	0.310	0.271	<0.001	40	large	LA-SR _{res} = -0.051 * LA_V _{min_i} + 0.011 * LV-GRS + 0.016 * E + 0.008 * age + 1.786
	2	LA-SR _{res}	LA_Vol _{min_i} E	0.514	0.265	0.246	<0.001	39	large	LA-SR _{res} = -0.043 * LA_V _{min_i} + 0.011 * E + 2.505
conduit	3	LA-SR _{con}	LA_Vol _{boo_i} , LA-EF _{tot} , S/D E	0.540	0.291	0.252	<0.001	43	large	LA-SR _{con} = 0.034 * LA_V _{boo_i} - 7*E-5 * LA-EF _{tot} + 0.028 * S/D - 0.038 * E - 2.142
	4	LA-SR _{con}	LA-EF _{con} , LV-GRS, MM _i age	0.502	0.252	0.210	<0.001	51	medium	LA-SR _{con} = -0.048 * LA-EF _{con} - 0.045 * LV-GRS + 0.004 * MM _i + 0.007 * age - 0.583
	5	LA-SR _{con}	LA_Vol _{boo_i} E	0.542	0.293	0.275	<0.001	34	large	LA-SR _{con} = 0.035 * LA_V _{boo_i} - 0.039 * E - 2.104
booster	6	LA-SR _{boo}	LA-EF _{boo} , LV-GCS, S/D A	0.440	0.194	0.148	0.004	69	medium	LA-SR _{boo} = -0.016 * LA-EF _{boo} + 0.133 * LV-GCS + 0.233 * S/D - 0.034 * A + 1.503
	7	LA-SR _{boo}	LA-EF _{boo} , A, LV-EDV _i MM _i	0.414	0.172	0.127	0.007	86	medium	LA-SR _{boo} = -0.019 * LA-EF _{boo} - 0.032 * A + 0.011 * LV-EDV _i + 0.015 * MM _i - 2.387

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Interpretation of $|R^2|$ according to Cohen. [Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, N.J.: L. Erlbaum Associates. Page 412 ff].

small effect size: $|R^2| = .02$; medium effect size $|R^2| = .13$; large effect size $|R^2| = .26$.

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LA-S_{res}, reservoir left atrial strain; LA-S_{con}, conduit left atrial strain; LA-S_{boo}, booster left atrial strain; LA-SR_{res}, reservoir left atrial strain rate; LA-SR_{con}, conduit left atrial strain rate; LA-SR_{boo}, booster left atrial strain rate; LA-Vol_{max_i}, indexed maximum left atrial volume; LA-Vol_{min_i}, indexed minimum left atrial volume; LA-Vol_{boo_i}, indexed booster left atrial volume; LA-EF_{total}, total left atrial ejection fraction; LA-EF_{con}, passive left atrial ejection fraction; LA-EF_{boo}, booster left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; $\dot{e}$, mean lateral and septal cine CMR velocities; E/ $\dot{e}$, ratio E-wave to $\dot{e}$; MAPSE, Mitral annulus plain systolic excursion; SI, Sphericity index; MM_i, BSA-indexed muscle-mass; LV-EDV_i, indexed left ventricular end diastolic volume; LV-ESV_i, indexed left ventricular end systolic volume; LV-SV_i, indexed left ventricular stroke volume.

Table S2c: Multi-linear regression analysis to study multifactorial influences of left atrial strain. Analysis was done on female subjects (N = 60) with heart rates between 60 – 75 bpm.

	validity	Parameter	R	R ²	corr R ²	ANOVA significance	Sample size [†]	Goodness-of-fit	Function
reservoir	1	LA-S _{res} LA-Vol _{min_i} , LA-EF _{tot} , LV-GCS E	-	-	-	-	-	-	-
	2	LA-S _{res} E, LV-GCS LA-EF _{tot}	0.527	0.278	0.238	< 0.001	41	large	LA-S _{res} = 0.825 * LA-EF _{tot} + 2.633 * LV-GCS + 0.250 * E + 44.270
	3	LA-S _{res} LV-GRS, LV-EF, LA-EF _{tot} , MM _i	0.459	0.211	0.151	0.012	63	medium	LA-S _{res} = -0.846 * LV-GRS + 0.227 * LV-EF + 0.807 * LA-EF _{tot} - 0.159 * MM _i + 29.681
	3a	LA-S _{res} LV-GRS LA-EF _{tot}	0.451	0.204	0.175	0.002	53	medium	LA-S _{res} = -0.747 * LV-GRS + 0.839 * LA-EF _{tot} + 31.363

conduit	4	LA-S _{con}	LA-Vol _{boo_i} , LA-EF _{tot} , LV-GRS E	0.661	0.437	0.395	< 0.001	26	large	LA-S _{con} = 0.185 * LA-V _{boo_i} + 0.931 * LA-EF _{tot} - 1.056 * LV-GRS + 0.351 * E - 5.403
	5	LA-S _{con}	LA-Vol _{min_i} , LV-GCS, E, S/D	0.632	0.400	0.355	<0.001	29	large	LA-S _{con} = -0.520 * LA-V _{min_i} + 3.227 * LV-GCS + 0.493 * E + 5.220 * S/D + 75.137
	6	LA-S _{con}	LA-EF _{con} , LV-GCS, age LV-ESV _i	0.640	0.410	0.366	<0.001	28	large	LA-S _{con} = 0.651 * LA-EF _{con} + 1.774 * LV-GCS - 0.080 * age + 0.207 * LV-ESV _i + 45.528
	6a	LA-S _{con}	LV-GCS, LA-Vol _{min_i} E	0.607	0.369	0.334	<0.001	29	large	LA-S _{con} = 2.970 * LV-GCS - 0.183 * LA-V _{min_i} + 0.454 * E + 71.372
booster	7	LA-S _{boo}	LA-EF _{boo} , LV-EF, A S/D	0.635	0.404	0.359	< 0.001	28	large	LA-S _{boo} = 0.405 * LA-EF _{boo} - 0.278 * LV-EF + 0.280 * A + 2.107 * S/D + 12.264
	8	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i , age A	0.647	0.418	0.374	<0.001	27	large	LA-S _{boo} = 0.430 * LA-EF _{boo} + 0.286 * LV-ESV _i + 0.116 * age + 0.138 * A - 11.988
	9	LA-S _{boo}	LA-Vol _{boo_i} , LA-EF _{boo} , MM _i BMI	0.564	0.318	0.267	<0.001	39	large	LA-S _{boo} = 0.233 * LA-V _{boo_i} + 0.397 * LA-EF _{boo} - 0.156 * MM _i + 0.041 * BMI + 3.628
	10	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i A	0.611	0.373	0.339	<0.001	29	large	LA-S _{boo} = 0.428 * LA-EF _{boo} + 0.152 * LV-ESV _i + 0.317 * A - 9.311

reservoir	1	LA-SR _{res}	LA_Vol _{min_i} , LV-GRS; E age	0.456	0.208	0.147	0.015	64	medium	LA-SR _{res} = -0.018 * LA_V _{min_i} - 0.036 * LV-GRS + 0.019 * E - 0.003 * age + 2.956
	2	LA-SR _{res}	LA_Vol _{min_i} E	0.334	0.111	0.080	0.037	105	small	LA-SR _{res} = -0.034 * LA_V _{min_i} + 0.018 * E + 1.962
conduit	3	LA-SR _{con}	LA_Vol _{boo_i} , LA-EF _{tot} , S/D E	0.593	0.351	0.301	<0.001	34	large	LA-SR _{con} = 0.056 * LA_V _{boo_i} - 0.039 * LA-EF _{tot} - 0.054 * S/D - 0.041 * E - 0.615
	4	LA-SR _{con}	LA-EF _{con} , LV-GRS, MM _i age	0.586	0.344	0.293	<0.001	35	large	LA-SR _{con} = -0.049 * LA-EF _{con} + 0.068 * LV-GRS + 0.042 * MM _i + 0.013 * age - 6.823
	5	LA-SR _{con}	LA_Vol _{boo_i} E	0.579	0.335	0.310	<0.001	29	large	LA-SR _{con} = 0.067 * LA_V _{boo_i} - 0.043 * E - 3.056
booster	6	LA-SR _{boo}	LA-EF _{boo} , LV-GCS, S/D A	0.432	0.187	0.125	0.027	72	medium	LA-SR _{boo} = -0.015 * LA-EF _{boo} - 0.041 * LV-GCS - 0.477 * S/D - 0.014 * A - 1.693
	7	LA-SR _{boo}	LA-EF _{boo} , A, LV-EDV _i MM _i	0.505	0.255	0.199	0.003	51	medium	LA-SR _{boo} = -0.008 * LA-EF _{boo} - 0.035 * A - 0.019 * LV-EDV _i + 0.041 * MM _i - 1.773
	7a	LA-SR _{boo}	A, MM _i	0.466	0.217	0.189	0.001	49	medium	LA-SR _{boo} = -0.030 * A + 0.032 * MM _i - 3.085

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Interpretation of $|R^2|$ according to Cohen. [Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, N.J.: L. Erlbaum Associates. Page 412 ff].

small effect size: $|R^2| = .02$; medium effect size $|R^2| = .13$; large effect size $|R^2| = .26$.

[†] Sample size calculation see reference [Calculation according to Hemmerich, W. (2019). StatistikGuru: Poweranalyse und Stichprobenberechnung für Regression. Retrieved from <https://statistikguru.de/rechner/poweranalyse-regression.html>].

LA-S_{res}, reservoir left atrial strain; LA-S_{con}, conduit left atrial strain; LA-S_{boo}, booster left atrial strain; LA-SR_{res}, reservoir left atrial strain rate; LA-SR_{con}, conduit left atrial strain rate; LA-SR_{boo}, booster left atrial strain rate; LA-Vol_{max_i}, indexed maximum left atrial volume; LA-Vol_{min_i}, indexed minimum left atrial volume; LA-Vol_{boo_i}, indexed booster left atrial volume; LA-EF_{total}, total left atrial ejection fraction; LA-EF_{con}, passive left atrial ejection fraction; LA-EF_{boo}, booster left atrial ejection fraction; LV-EF, left ventricular ejection fraction; LV-GLS, global left ventricular longitudinal strain; LV-GCS, global left ventricular circumferential strain; LV-GRS, global left ventricular radial strain; S/D, ratio S-wave to D-wave by quantitative right upper pulmonary vein blood flow measurements; E/A, ratio E-wave to A-wave by quantitative transmitral blood flow measurements; E, E-wave by quantitative transmitral blood flow measurements; A, A-wave by quantitative transmitral blood flow measurements; $\dot{e}$, mean lateral and septal cine CMR velocities; E/ $\dot{e}$, ratio E to $\dot{e}$; MAPSE, Mitral annulus plain systolic excursion; SI, Sphericity index; MM_i, BSA-indexed muscle-mass; LV-EDV_i, indexed left ventricular end diastolic volume; LV-ESV_i, indexed left ventricular end systolic volume; LV-SV_i, indexed left ventricular stroke volume.

Table S2d: Multi-linear regression analysis to study multifactorial influences of left atrial strain. Analysis was done on male subjects (N = 46) with heart rates between 60 – 75 bpm.

	validity	Parameter	R	R ²	corr R ²	ANOVA significance	Sample size [†]	Goodness-of-fit	Function
reservoir	1	LA-S _{res} LA-Vol _{min_i} , LA-EF _{tot} , LV-GCS E	-	-	-	-	-	-	-
	2	LA-S _{res} E, LV-GCS LA-EF _{tot}	0.565	0.320	0.267	0.002	35	large	LA-S _{res} = 0.897 * LA-EF _{tot} - 1.114 * LV-GCS + 0.212 * E - 36.764
	3	LA-S _{res} LV-GRS, LV-EF, LA-EF _{tot} , MM _i	0.502	0.252	0.173	0.023	51	medium	LA-S _{res} = 0.455 * LV-GRS - 0.122 * LV-EF + 0.898 * LA-EF _{tot} - 0.030 * MM _i - 10.139

conduit	4	LA-S _{con}	LA-Vol _{boo_i} , LA-EF _{tot} , LV-GRS E	0.637	0.405	0.341	0.001	28	large	LA-S _{con} = -0.004 * LA-V _{boo_i} + 0.458 * LA-EF _{tot} + 0.030 * LV-GRS + 0.437 * E - 21.650
	5	LA-S _{con}	LA-Vol _{min_i} , LV-GCS, E, S/D	0.628	0.395	0.327	0.001	29	large	LA-S _{con} = -0.528 * LA-V _{min_i} + 0.508 * LV-GCS + 0.589 * E + 4.312 * S/D + 12.336
	6	LA-S _{con}	LA-EF _{con} , LV-GCS, age LV-ESV _i	0.488	0.238	0.160	0.028	55	medium	LA-S _{con} = 0.764 * LA-EF _{con} - 0.438 * LV-GCS + 0.167 * age - 0.046 * LV-ESV _i - 7.651
booster	7	LA-S _{boo}	LA-EF _{boo} , LV-EF, A S/D	0.427	0.182	0.100	0.083	75	medium	LA-S _{boo} = 0.254 * LA-EF _{boo} + 0.133 * LV-EF + 0.175 * A - 1.699 * S/D - 4.050
	8	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i , age A	0.466	0.217	0.139	0.040	61	medium	LA-S _{boo} = 0.209 * LA-EF _{boo} - 0.259 * LV-ESV _i - 0.008 * age + 0.120 * A + 13.311
	9	LA-S _{boo}	LA-Vol _{boo_i} , LA-EF _{boo} , MM _i BMI	0.412	0.170	0.087	0.106	81	medium	LA-S _{boo} = 0.009 * LA-V _{boo_i} + 0.249 * LA-EF _{boo} - 0.157 * MM _i - 0.110 * BMI + 20.295
	10	LA-S _{boo}	LA-EF _{boo} , LV-ESV _i A	0.465	0.217	0.159	0.018	56	medium	LA-S _{boo} = 0.205 * LA-EF _{boo} - 0.255 * LV-ESV _i + 0.110 * A + 13.322

reservoir	1	LA-SR _{res}	LA_Vol _{min_i} , LV-GRS; E age	0.619	0.383	0.316	0.001	31	large	LA-SR _{res} = -0.074 * LA_V _{min_i} + 0.009 * LV-GRS + 0.023 * E + 0.014 * age + 1.747
	2	LA-SR _{res}	LA_Vol _{min_i} E	0.479	0.229	0.191	0.005	46	medium	LA-SR _{res} = -0.046 * LA_V _{min_i} + 0.016 * E + 2.242
conduit	3	LA-SR _{con}	LA_Vol _{boo_i} , LA-EF _{tot} , S/D E	0.551	0.304	0.230	0.007	41	large	LA-SR _{con} = 0.027 * LA_V _{boo_i} + 0.018 * LA-EF _{tot} - 0.119 * S/D - 0.056 * E - 1.774
	4	LA-SR _{con}	LA-EF _{con} , LV-GRS, MM _i age	0.580	0.337	0.265	0.004	36	large	LA-SR _{con} = -0.105 * LA-EF _{con} - 0.027 * LV-GRS - 0.025 * MM _i - 0.021 * age + 3.445
	5	LA-SR _{con}	LA_Vol _{boo_i} E	0.567	0.321	0.288	<0.001	30	large	LA-SR _{con} = 0.019 * LA_V _{boo_i} - 0.054 * E - 0.749
booster	6	LA-SR _{boo}	LA-EF _{boo} , LV-GCS, S/D A	0.582	0.339	0.267	0.003	36	large	LA-SR _{boo} = -0.029 * LA-EF _{boo} + 0.075 * LV-GCS + 0.029 * S/D - 0.032 * A + 1.023
	7	LA-SR _{boo}	LA-EF _{boo} , A, LV-EDV _i MM _i	0.704	0.496	0.443	<0.001	22	large	LA-SR _{boo} = -0.020 * LA-EF _{boo} - 0.035 * A + 0.027 * LV-EDV _i + 0.016 * MM _i - 3.764

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