

**Table S1.** The primary patient inclusion and exclusion criteria for the HUC-HEART Trial (ClinicalTrials.gov Identifier: NCT02323477)

Inclusion criteria	Exclusion criteria
30- to 80-year-old male patients with ischemic heart disease who agreed to participate in the study and undergo CABG	Acute cardiac decompensation
25% < LVEF < 45% (measured via cardiac MRI and echocardiography)	Acute myocardial infarction
NYHA class II-IV patients	Congenital heart disease
Hemodynamic stability (patients not requiring pre-operative intra-aortic balloon pump or inotropic/blood pressure support).	Additional surgical heart disease other than coronary artery disease
	Malignant arrhythmia
	All malignancies
	HbA1c level >10% (86 mmol/mol), type II diabetes mellitus
	Severe liver dysfunction
	Severe chronic obstructive pulmonary disease
	Coagulopathy
	Immunosuppressive treatment
	Acute hepatitis,
	Hepatitis B, C or HIV infection
	Chronic liver or renal failure
	Connective tissue disease
	Stroke
	Active tuberculosis
	Chronic hematological diseases
	Social and mental disabilities
	Acute cardiac decompensation

**Table S2.** Postproduction quality control and fractional analysis of cell harvests to be transplanted

Measured variable	BM-MNCs	HUC-MSCs
Cell number, mean (min-max)	$70 \times 10^7$	$21 \sim 26 \times 10^6$
Viability rate, mean % (min-max)	ND	93.4 (91.9~94.9)
CD34, mean % (min-max)	0.052 (0.043~0.065)	<0.01
CD45, mean % (min-max)	71.8 (60.3~83.1)	<0.01
CD73, mean % (min-max)	ND	99.9 (99.8~100.0)
CD90, mean % (min-max)	ND	99.8 (99.6~100.0)
CD105, mean % (min-max)	ND	97.7 (97.3~98.1)
Proliferation rate <sup>a</sup>	ND	3.1 (2.7~3.5)
Karyotype stability	ND	++++

ND: not determined.

<sup>a</sup>Fold increase [mean, (min-max)] in the number of cultured cells for 6 days.

**Table S3.** Statistical tests used in the HUC-HEART trial

Parameters	Statistical tests used
Age (Table 2)	Kruskal-Wallis
Smoking (Table 2)	Chi-Square
Alcohol consumption (Table 2)	Chi-Square
Type 2 DM (Table 2)	Chi-Square
Hypertension (Table 2)	Chi-Square
TIA (Table 2)	Chi-Square
Hypercholesterolemia (Table 2)	Chi-Square
Stroke (Table 2)	Chi-Square
No of Bypass Graft (Table 2)	Kruskal-Wallis
Common laboratory findings (Supplementary Table S2)	Kruskal-Wallis or One-way ANOVA, where appropriate
Left ventricle volume measurements by MRI (Supplementary Table S3)	One-way ANOVA
NYHA (Table 4)	One-way ANOVA
NT-proBNP (Fig. 3)	Kruskal-Wallis (for group comparison), Friedman (time follow-up, post-hoc Wilcoxon with Bonferroni corrections)
LVEF change (%) by MRI (Fig. 4A)	Kruskal-Wallis (group comparison), Wilcoxon (baseline -12-month follow-up)
LVEF change (%) by SPECT (Fig. 4B)	Kruskal-Wallis (group comparison), Wilcoxon (baseline -12-month follow-up)
LVEF change (%) by Echo (Fig. 4C)	Friedman test (time follow-up, post-hoc Wilcoxon with Bonferroni corrections)
LVEF change ratio by MRI, SPECT and Echo (Fig. 4D)	Kruskal-Wallis
Wall motion change by segments (Fig. 6A)	Descriptive
Scar score by segments (Fig. 6B)	Descriptive
Wall thickness change (Fig. 6C)	Kruskal-Wallis (group comparison), Wilcoxon (baseline -12-month follow-up)
Myocardial mass change (Fig. 6D)	Kruskal-Wallis (group comparison), Paired sample t test (baseline -12-month follow-up)
Hibernating and necrotic area changes by PET (Fig. 7A and B)	Kruskal-Wallis (group comparison), Wilcoxon (baseline -12-month follow-up)
Holter rhythm monitoring (Table 3)	Wilcoxon (baseline-12 months)
6-min walking test (Fig. 8)	Paired sample t test (baseline -12-month follow-up), Repeated measures ANOVA (group comparison)

**Table S4.** Common laboratory findings at baseline and after transplantation (1, 3, 6 and 12 months)

	Months	Control	BM-MNC	HUC-MSC	Significance*
CK-MB	Baseline	2.6 (11.4)	14.0 (34.7)	2.7 (14.6)	$\chi^2=6.283$ ; $p=0.043$ (I-II) <sup>a</sup>
Median (IQR)	1	1.7 (10.5)	10.0 (11.5)	3.1 (12.2)	$\chi^2=2.382$ ; $p=0.304$
$\mu\text{g/dl}$	3	12.0 (13.1)	5.0 (8.4)	6.2 (13.7)	$\chi^2=0.187$ ; $p=0.911$
	6	13.0 (17.8)	11.0 (20.8)	4.1 (13.6)	$\chi^2=0.589$ ; $p=0.752$
	12	2.0 (11.5)	2.1 (9.3)	4.0 (14.3)	$\chi^2=0.990$ ; $p=0.610$
Troponin-I	Baseline	0.017 (0.785)	0.060 (0.27)	0.060 (0.382)	$\chi^2=1.587$ ; $p=0.452$
Median (IQR)	1	0.022 (0.048)	0.030 (0.027)	0.029 (0.041)	$\chi^2=0.359$ ; $p=0.836$
ng/ml	3	0.01 (0.014)	0.014 (0.070)	0.020 (0.022)	$\chi^2=3.910$ ; $p=0.142$
	6	0.018 (0.073)	0.020 (0.011)	0.012 (0.032)	$\chi^2=0.403$ ; $p=0.818$
	12	0.011 (0.023)	0.025 (0.053)	0.014 (0.051)	$\chi^2=1.698$ ; $p=0.428$
HGB	Baseline	14.5 $\pm$ 0.4	13.4 $\pm$ 0.4	13.8 $\pm$ 0.4	F=1.503; $p=0.232$
Mean $\pm$ SE g/dl	1	13.3 $\pm$ 0.3	12.5 $\pm$ 0.5	12.7 $\pm$ 0.4	F=1.253; $p=0.295$
	3	14.2 $\pm$ 0.4	13.4 $\pm$ 0.5	13.7 $\pm$ 0.4	F=0.673; $p=0.515$
	6	13.9 $\pm$ 0.4	14.3 $\pm$ 0.4	14.1 $\pm$ 0.5	F=0.095; $p=0.910$
	12	14.0 $\pm$ 0.5	14.1 $\pm$ 0.4	14.5 $\pm$ 0.4	F=0.318; $p=0.729$
Platelet	Baseline	229.3 $\pm$ 18.3	240.3 $\pm$ 18.3	244.1 $\pm$ 17.1	F=0.191; $p=0.827$
Mean $\pm$ SE 10 <sup>9</sup> /L	1	253.4 $\pm$ 20.1	294.1 $\pm$ 22.7	294.2 $\pm$ 20.4	F=1.259; $p=0.294$
	3	228.5 $\pm$ 16.9	274.0 $\pm$ 20.6	237.3 $\pm$ 13.8	F=1.780; $p=0.161$
	6	208.4 $\pm$ 11.4	253.6 $\pm$ 20.0	226.9 $\pm$ 15.1	F=1.606; $p=0.213$
	12	225.3 $\pm$ 17.5	237.1 $\pm$ 22.2	220.3 $\pm$ 10.2	F=0.243; $p=0.786$
WBC	Baseline	8.9 (2.8)	8.5 (2.8)	8.5 (3.7)	$\chi^2=0.551$ ; $p=0.759$
Median (IQR)	1	8.4 (3.1)	8.3 (1.0)	8.6 (3.1)	$\chi^2=0.164$ ; $p=0.921$
10 <sup>9</sup> /L	3	7.7 (3.6)	8.1 (1.5)	7.3 (2.5)	$\chi^2=0.572$ ; $p=0.751$
	6	7.5 (1.5)	9.1 (4.1)	7.5 (2.4)	$\chi^2=4.501$ ; $p=0.105$
	12	7.8 (1.7)	8.4 (1.2)	8.5 (2.8)	$\chi^2=1,394$ ; $p=0.498$
Glycose	Baseline	122.5 (67.8)	122.5 (163.5)	144.0 (138.8)	$\chi^2=1.416$ ; $p=0.493$
Median (IQR)	1	115.0 (58.5)	109.0 (61.0)	135.0 (95.3)	$\chi^2=1.355$ ; $p=0.508$
mg/dl	3	109.5 (79.5)	105.0 (147.0)	157.5 (126.8)	$\chi^2=1.781$ ; $p=0.410$
	6	105.0 (56.0)	134.0 (142.0)	135.5 (138.3)	$\chi^2=1.212$ ; $p=0.545$
	12	113.0 (75.3)	112.5 (27.3)	151.5 (83.0)	$\chi^2=3.938$ ; $p=0.140$
Urea	Baseline	34.0 (18.3)	37.5 (20.5)	42.0 (15.5)	$\chi^2=0.343$ ; $p=0.843$
Median (IQR)	1	38.0 (11.0)	32.5 (24.0)	39.0 (20.3)	$\chi^2=1.525$ ; $p=0.467$
mg/dl	3	36.5 (10.9)	32.0 (27.0)	37.0 (24.0)	$\chi^2=0.953$ ; $p=0.621$
	6	32.0 (11.3)	33.0 (18.8)	35.5 (10.5)	$\chi^2=1.440$ ; $p=0.487$
	12	44.5 (18.3)	34.5 (10.3)	33.5 (14.8)	$\chi^2=3.766$ ; $p=0.152$
Creatinine	Baseline	1.0 (0.4)	1.0 (0.2)	1.0 (0.5)	$\chi^2=0.014$ ; $p=0.993$
Median (IQR)	1	1.0 (0.3)	1.0 (0.4)	1.0 (0.3)	$\chi^2=0.301$ ; $p=0.860$
mg/dl	3	1.0 (0.3)	1.0 (0.4)	1.0 (0.3)	$\chi^2=0.044$ ; $p=0.978$
	6	1.0 (0.2)	1.0 (0.3)	1.0 (0.3)	$\chi^2=0.344$ ; $p=0.842$
	12	1.1 (0.3)	1.0 (0.4)	1.0 (0.4)	$\chi^2=0.464$ ; $p=0.793$

Table S4. Continued

	Months	Control	BM-MNC	HUC-MSC	Significance*
AST	Baseline	20.0 (12.8)	18.5 (11.5)	16.0 (7.0)	$\chi^2=2.854$ ; p=0.240
Median (IQR)	1	17.0 (7.3)	15.5 (9.5)	16.5 (7.0)	$\chi^2=0.197$ ; p=0.906
U/L	3	18.0 (5.0)	19.0 (5.0)	15.0 (4.5)	$\chi^2=4.787$ ; p=0.091
	6	17.3 (7.5)	17.5 (6.0)	18.5 (5.0)	$\chi^2=0.814$ ; p=0.666
	12	16.0 (4.3)	16.5 (7.8)	16.0 (5.8)	$\chi^2=0.179$ ; p=0.915
ALT	Baseline	24.0 (25.0)	21.5 (9.0)	19.0 (9.5)	$\chi^2=3.912$ ; p=0.141
Median (IQR)	1	16.5 (8.8)	17.5 (17.5)	14.0 (5.5)	$\chi^2=2.328$ ; p=0.312
U/L	3	18.0 (7.7)	19.0 (8.0)	16.0 (10.0)	$\chi^2=1.785$ ; p=0.410
	6	16.0 (5.5)	21.0 (9.5)	16.0 (9.0)	$\chi^2=1.066$ ; p=0.587
	12	16.5 (13.5)	17.0 (6.0)	16.0 (8.8)	$\chi^2=0.538$ ; p=0.764
LDH	Baseline	222.0 (147.0)	191.0 (209.0)	204.0 (81.0)	$\chi^2=0.014$ ; p=0.993
Median (IQR)	1	186.0 (73.8)	176.0 (75.8)	207.0 (95.5)	$\chi^2=1.504$ ; p=0.471
U/L	3	183.0 (38.0)	186.5 (88.8)	195.5 (52.5)	$\chi^2=0.240$ ; p=0.887
	6	188.0 (53.0)	179.0 (72.3)	190.5 (50.5)	$\chi^2=0.595$ ; p=0.743
	12	195.0 (62.0)	187.0 (43.0)	195.0 (50.5)	$\chi^2=1.080$ ; p=0.583
Amylase	Baseline	69.0 (44.3)	45.0 (45.5)	64.0 (21.0)	$\chi^2=3.444$ ; p=0.179
Median (IQR)	1	70.0 (35.0)	62.5 (37.0)	72.0 (49.0)	$\chi^2=1.054$ ; p=0.590
U/L	3	71.0 (48.5)	61.5 (33.5)	81.0 (53.5)	$\chi^2=1.673$ ; p=0.433
	6	73.0 (42.1)	57.0 (52.3)	75.5 (43.3)	$\chi^2=0.880$ ; p=0.644
	12	80.0 (42.0)	66.0 (39.0)	77.0 (42.5)	$\chi^2=0.628$ ; p=0.731
Lipase	Baseline	28.0 (26.0)	18.0 (14.8)	28.0 (13.0)	$\chi^2=5.364$ ; p=0.068
Median (IQR)	1	27.0 (27.0)	23.0 (21.5)	34.0 (30.5)	$\chi^2=4.376$ ; p=0.112
U/L	3	24.5 (13.5)	23.0 (23.5)	37.0 (30.5)	$\chi^2=4.857$ ; p=0.088
	6	28.0 (27.5)	28.0 (32.5)	37.0 (17.0)	$\chi^2=1.943$ ; p=0.379
	12	28.0 (20.8)	30.0 (14.0)	39.0 (35.8)	$\chi^2=2.979$ ; p=0.226
Total Protein	Baseline	6.9±0.2	6.8±0.2	6.9±0.1	F=0.125; p=0.883
Mean±SE	1	7.2±0.1	7.3±0.2	7.3±0.1	F=0.156; p=0.856
g/dl	3	7.3±0.1	7.2±0.1	7.3±0.2	F=0.317; p=0.730
	6	7.4±0.1	7.5±0.1	7.4±0.1	F=0.407; p=0.669
	12	7.0±0.1	7.2±0.1	7.1±0.1	F=0.388; p=0.681
Albumin	Baseline	4.1 (0.8)	4 (0.8)	4.2 (0.4)	$\chi^2=0.991$ ; p=0.609
Median (IQR)	1	4.1 (0.7)	4.2 (0.9)	3.9 (0.7)	$\chi^2=0.993$ ; p=0.609
g/dl	3	4.3 (0.4)	4.2 (0.8)	4.4 (0.5)	$\chi^2=2.087$ ; p=0.352
	6	4.4 (0.4)	4.4 (0.8)	4.4 (0.3)	$\chi^2=1.133$ ; p=0.567
	12	4.4 (0.3)	4.3 (0.6)	4.4 (0.4)	$\chi^2=0.032$ ; p=0.984
Total Bilirubin	Baseline	0.6 (0.4)	0.6 (0.9)	0.6 (0.5)	$\chi^2=0.434$ ; p=0.805
Median (IQR)	1	0.6 (0.3)	0.5 (0.3)	0.4 (0.2)	$\chi^2=3.384$ ; p=0.184
mg/dl	3	0.5 (0.3)	0.5 (0.3)	0.5 (0.3)	$\chi^2=0.620$ ; p=0.733
	6	0.9 (0.6)	0.7 (0.5)	0.7 (0.3)	$\chi^2=1.410$ ; p=0.494
	12	0.6 (0.4)	0.6 (0.6)	0.6 (0.6)	$\chi^2=0.305$ ; p=0.858

Table S4. Continued

	Months	Control	BM-MNC	HUC-MSC	Significance*
Direct Bilirubin	Baseline	0.2 (0.1)	0.2 (0.1)	0.2 (0.1)	$\chi^2=1.287$ ; $p=0.525$
Median (IQR)	1	0.2 (0.1)	0.1 (0.1)	0.1 (0.1)	$\chi^2=3.436$ ; $p=0.179$
mg/dl	3	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	$\chi^2=0.097$ ; $p=0.953$
	6	0.2 (0.2)	0.2 (0.1)	0.2 (0.1)	$\chi^2=0.183$ ; $p=0.912$
	12	0.2 (0.1)	0.2 (0.1)	0.2 (0.2)	$\chi^2=0.138$ ; $p=0.934$
Cholesterol	Baseline	173.5 (43.0)	150.5 (67.5)	172.0 (80.0)	$\chi^2=0.705$ ; $p=0.703$
Median (IQR)	1	147.0 (47.0)	158.0 (76.0)	138.0 (55.5)	$\chi^2=1.521$ ; $p=0.467$
mg/dl	3	186.5 (95.4)	144.0 (112.0)	167.0 (73.5)	$\chi^2=0.944$ ; $p=0.624$
	6	212.0 (87.3)	146.0 (54.5)	164.0 (52.5)	$\chi^2=3.383$ ; $p=0.184$
	12	208.5 (109.3)	156.5 (63.0)	173.0 (62.0)	$\chi^2=1.062$ ; $p=0.588$
HDL	Baseline	43.1 $\pm$ 2.8	37.5 $\pm$ 3.0	36.7 $\pm$ 2.2	F=1.846; $p=0.169$
Mean $\pm$ SE	1	41.9 $\pm$ 2.4	40.2 $\pm$ 3.1	36.9 $\pm$ 1.8	F=1.428; $p=0.250$
mg/dl	3	42.1 $\pm$ 3.0	38.0 $\pm$ 2.2	39.4 $\pm$ 2.0	F=0.618; $p=0.544$
	6	41.6 $\pm$ 3.0	43.6 $\pm$ 2.8	38.9 $\pm$ 1.6	F=1.004; $p=0.376$
	12	43.8 $\pm$ 2.8	35.7 $\pm$ 2.2	39.3 $\pm$ 2.6	F=1.550; $p=0.225$
LDL	Baseline	93.9 $\pm$ 7.5	94.6 $\pm$ 11.7	94.2 $\pm$ 7.0	F=0.002; $p=0.998$
Mean $\pm$ SE	1	76.8 $\pm$ 5.8	90.5 $\pm$ 8.7	78.6 $\pm$ 6.5	F=0.900; $p=0.413$
mg/dl	3	105.4 $\pm$ 11.6	96.5 $\pm$ 13.3	93.7 $\pm$ 10.0	F=0.309; $p=0.736$
	6	118.1 $\pm$ 13.7	105.6 $\pm$ 14.0	102.4 $\pm$ 7.8	F=0.576; $p=0.567$
	12	117.7 $\pm$ 15.9	97.4 $\pm$ 9.7	107.3 $\pm$ 6.9	F=0.641; $p=0.533$
Triglyceride	Baseline	150.0 (78.0)	96.0 (91.0)	129.0 (112.0)	$\chi^2=3.023$ ; $p=0.221$
Median (IQR)	1	140.0 (90.8)	125.0 (72.0)	116.0 (91.0)	$\chi^2=1.335$ ; $p=0.513$
mg/dl	3	180.5 (83.3)	134.0 (147.0)	170.0 (158.5)	$\chi^2=1.090$ ; $p=0.580$
	6	161.0 (33.3)	142.5 (79.8)	143.0 (110.5)	$\chi^2=0.767$ ; $p=0.681$
	12	145.0 (114.5)	167.5 (81.5)	158.0 (146.5)	$\chi^2=0.069$ ; $p=0.966$
TSH	Baseline	2.1 (1.7)	1.1 (2.1)	1.1 (1.9)	$\chi^2=1.768$ ; $p=0.409$
Median (IQR)	1	1.2 (1.2)	1.7 (2.8)	1.7 (2.0)	$\chi^2=0.029$ ; $p=0.986$
mU/L	3	1.2 (1.3)	1.5 (2.1)	1.3 (2.3)	$\chi^2=0.313$ ; $p=0.855$
	6	1.4 (2.1)	0.9 (1.9)	1.3 (1.5)	$\chi^2=0.911$ ; $p=0.634$
	12	1.6 (1.3)	1.3 (2.0)	1.4 (1.1)	$\chi^2=0.607$ ; $p=0.738$
Fibrinogen	Baseline	3.9 (1.3)	3.6 (1.1)	3.6 (1.1)	$\chi^2=0.267$ ; $p=0.875$
Median (IQR)	1	3.7 (1.3)	3.8 (1.5)	4.1 (1.8)	$\chi^2=0.679$ ; $p=0.712$
mg/dl	3	3.5 (1.3)	3.9 (0.8)	3.2 (1.6)	$\chi^2=3.034$ ; $p=0.219$
	6	3.4 (0.8)	3.4 (2.9)	3.3 (0.8)	$\chi^2=0.053$ ; $p=0.974$
	12	3.6 (1.1)	3.7 (1.4)	3.3 (1.4)	$\chi^2=0.561$ ; $p=0.756$

<sup>a</sup>Based on Bonferroni corrected Mann-Whitney test, only baseline CK-MB values between control and BM-MNC groups were found significantly different, albeit in normal range. CK-MB: blood creatine kinase, HGB: hemoglobin, WBC: white blood cell, AST: aspartate aminotransferase, ALT: alanine transaminase, LDH: lactate dehydrogenase, HDL: high-density lipoprotein, LDL: low-density lipoprotein, TSH: thyroid stimulating hormone.

\*  $\chi^2$ : Kruskal-Wallis test results; F: ANOVA test results.

**Table S5.** Left ventricle volume measurements by MRI comparing baseline with the end of 12-month follow-up

	Control			BM-MNC			HUC-MSC		
	Baseline	Month 12	Significance*	Baseline	Month 12	Significance*	Baseline	Month 12	Significance*
EDV (ml)	154.9 ± 15.4	155.9 ± 19.4	Z = 0.178 p = 0.859	192.0 ± 25.9	205.2 ± 24.5	Z = 0.405 p = 0.686	186.5 ± 14.1	192.8 ± 14.6	Z = 0.621 p = 0.535
ESV (ml)	100.8 ± 11.6	96.3 ± 13.9	Z = 0.533 p = 0.594	142.8 ± 24.5	147.2 ± 26.5	Z = 0.405 p = 0.686	135.8 ± 14.2	132.0 ± 14.9	Z = 0.621 p = 0.535
EDVI	81.3 ± 6.9	80.3 ± 9.1	Z = 0.415 p = 0.678	103.0 ± 14.1	109.6 ± 14.4	Z = 0.405 p = 0.686	97.7 ± 6.2	100.5 ± 7.4	Z = 0.362 p = 0.717
ESVI	52.8 ± 5.3	49.9 ± 7.0	Z = 0.652 p = 0.515	76.8 ± 13.6	78.9 ± 15.1	Z = 0.405 p = 0.686	72.8 ± 7.4	68.7 ± 7.7	Z = 1.030 p = 0.301
SV (ml)	54.1 ± 5.3	59.6 ± 8.2	Z = 0.356 p = 0.722	49.3 ± 6.3	58.0 ± 4.6	Z = 1.753 p = 0.080	50.8 ± 3.3	60.8 ± 2.6	Z = 2.637 p = 0.008 <sup>a</sup>
CO (l)	3.7 ± 0.4	4.1 ± 0.4	Z = 1.472 p = 0.141	3.8 ± 0.4	4.0 ± 0.2	Z = 0.677 p = 0.498	3.9 ± 0.4	4.2 ± 0.2	Z = 0.880 p = 0.379
CI	1.9 ± 0.2	2.1 ± 0.2	Z = 1.402 p = 0.161	2.0 ± 0.2	2.1 ± 0.1	Z = 0.674 p = 0.500	2.1 ± 0.2	2.2 ± 0.1	Z = 0.724 p = 0.469

<sup>a</sup>In HUC-MSC group only, the SV at month 12 compared to baseline increased significantly (Z = 2.637; p = 0.008).

All values are given as mean ± SE.

EDV: end-diastolic volume, ESV: end-systolic volume, EDVI: end-diastolic volume index, ESVI: end-systolic volume index, SV: stroke volume, CO: cardiac output, CI: cardiac index.  
\*Wilcoxon test results.