

Supplementary material

Untargeted metabolic profiling reveals potential biomarkers in myocardial infarct and its application

Hong Yao, Peiying Shi, Ling Zhang, Xiaohui Fan, Qing Shao, Yiyu Cheng

Table S1. The identification results for the candidate of potential biomarkers

Variable ID (primary)	Median retention time (min)	<i>m/z</i>	VIP	Identification results
Var_2	8.81	89	1.09	Lactate
Var_6	8.89	73.1	1.08	Lactate
Var_7	9.83	72.2	1.33	L-Alanine
Var_8	9.93	128.1	1.09	L-Alanine
Var_10	10.6	102.1	1.3	Unkown
Var_11	10.98	170.1	1.05	1,2-Butanediol
Var_12	11.1	112.2	1.05	Oxalate
Var_13	11.13	202.2	1.07	Oxalate
Var_14	11.18	132.2	1.08	Unkown
Var_15	11.23	131.1	1.06	2-oxy-Butanoic acid
Var_27	11.98	233.1	1.11	3-Hydroxy-butyrate
Var_30	12.77	68.1	1.04	Unkown
Var_31	12.78	188.1	1.04	Unkown
Var_32	12.81	86.1	1.05	Ethanethioic acid, S-(3-methylbutyl) ester
Var_33	12.95	241.1	1.03	Unkown
Var_39	14.04	148.1	1.07	L-Valine
Var_47	15.61	174.1	1.05	Urea
Var_48	15.62	131.1	1.05	Urea
Var_49	15.63	79.1	1.21	Urea
Var_50	15.64	159.1	1.02	Urea
Var_51	15.68	87.9	1.26	Urea
Var_52	15.69	69.1	1.22	Urea
Var_53	15.71	259.1	1.04	Urea
Var_58	15.8	87.1	1.03	Unkown
Var_57	15.8	100.1	1.03	Unkown
Var_59	15.81	60.1	1.13	Unkown
Var_60	15.84	61.1	1.22	Unkown
Var_61	15.85	84.1	1.04	Unkown

Var_67	15.95	205.1	1.24	Unkown
Var_69	15.97	177.1	1.25	Glycerol
Var_70	15.98	103.1	1.42	Glycerol
Var_71	15.98	133.1	1.36	Phosphate
Var_72	16.01	207.1	1.29	Phosphate
Var_73	16.02	299.1	1.18	Phosphate
Var_74	16.51	184.1	1.13	L-threonine
Var_81	16.61	161.1	1.14	Glycine
Var_85	16.97	247.1	1.47	Succinate
Var_86	17.29	71.1	1.23	L-glyceric acid
Var_88	17.32	110.1	1.31	Unkown
Var_87	17.32	159.1	1.21	Unkown
Var_89	17.4	255.2	1.11	4-Deoxyerythronic acid
Var_90	17.42	241.1	1.1	4-Deoxyerythronic acid
Var_91	17.73	245.1	1.03	Unkown
Var_92	17.78	188.2	1.03	L-Serine
Var_95	18.18	184.1	1.23	L-threonine
Var_98	18.79	160.1	1.09	2,4-Dihydroxy-butanoic acid
Var_104	19.01	228.1	1.2	Unkown
Var_106	19.15	104.1	1.15	Unkown
Var_109	19.88	158.2	1.18	Aminomalonic acid
Var_110	19.91	147.1	1.11	Malate
Var_114	20.25	98.1	1.01	2,3,4-trihydroxy-butanal
Var_117	20.54	156.1	1.04	5-Oxoproline
Var_116	20.54	157.1	1.04	5-Oxoproline
Var_121	20.72	156.1	1.07	2,3,4-Trihydroxybutyric acid
Var_122	20.79	174.1	1.14	Unkown
Var_123	21.09	120.1	1.08	Phenylalanine
Var_134	21.3	218.1	1.12	Proline
Var_135	22.48	263.2	1.3	Ribose
Var_136	22.59	252.1	1.1	Ribose
Var_143	23.4	437.2	1.32	Unkown
Var_144	24.3	257.1	1.15	Citrate
Var_146	24.34	215.1	1.14	Citrate
Var_149	24.36	67.1	1.28	Citrate
Var_154	24.83	218.2	1.12	Rhamnose
Var_155	24.84	217.1	1.07	Rhamnose
Var_156	24.85	257.2	1.06	Rhamnose
Var_157	24.89	157.1	1.03	Unkown
Var_158	24.91	244.2	1.1	Unkown
Var_159	24.93	163.1	1.14	Unkown
Var_160	24.94	174.2	1.21	Unkown

Var_161	24.96	247.2	1.06	Unkown
Var_162	24.97	156.2	1.2	Unkown
Var_163	25	200.2	1.28	Unkown
Var_166	25.56	366.2	1.34	D-Glucose
Var_167	25.57	73.2	1.08	D-Glucose
Var_171	25.61	233.2	1.01	D-Glucose
Var_179	26.06	318.2	1.01	D-Glucitol
Var_185	27.12	217.1	1.17	D-Glucose
Var_187	28.28	205.1	1.4	Unkown
Var_191	28.87	83.2	1.07	Palmitate
Var_192	29.05	267.2	1.28	Unkown
Var_193	29.06	268.2	1.28	Unkown
Var_194	29.51	305.2	1.02	Myo-Inositol
Var_202	31.69	150.2	1.04	9,12-Octadecadienoic acid
Var_201	31.69	338.3	1.02	9,12-Octadecadienoic acid
Var_203	31.7	122.2	1.16	trans-9-Octadecenoic acid
Var_204	31.71	93.1	1.56	Oleate
Var_205	31.72	75.1	1.46	Oleate
Var_207	31.73	129.1	1.23	Oleate
Var_206	31.73	96.2	1.21	Oleate
Var_208	31.75	145.1	1.02	Oleate
Var_210	31.77	84.1	1.12	Oleate
Var_214	32.15	341.3	1.21	Octadecanoate
Var_217	33.66	80.1	1.2	Unkown
Var_218	33.67	67.1	1.38	Unkown
Var_220	34.05	342.4	1.02	Unkown
Var_221	35.09	169.1	1.26	Unkown
Var_222	35.1	361.2	1.32	Unkown
Var_223	35.38	167.1	1.2	Unkown
Var_224	35.57	108.2	1.06	1-hexadecanoyl-glycerol
Var_227	36.14	362.2	1.31	Galactopyranose-1-phosphate
Var_228	36.15	243.2	1.28	Sucrose
Var_229	36.15	169.1	1.27	Sucrose
Var_230	36.16	129.1	1.27	D-Turanose
Var_231	37.4	399.1	1.35	1-Octadecanoyl-glycerol
Var_232	40.5	502.1	1.37	Vitamin E
Var_244	40.62	71.2	1.51	Cholesterol
Var_248	41.79	343.4	1.03	(3 α ,24 β)-ergost-5-en-3-ol
Var_252	42.94	357.4	1.01	β -Sitosterol

Table S2. The relative levels and *t*-test results of the potential biomarkers in rat sera of C-7, C-14, MI-7 and MI-14 groups*

Peak No.	Metabolites	t_R (min)	C-7 (n=6)	MI-7 (n=6)	C-14 (n=11)	MI-14 (n=10)	P value for t-test		
							C-7 & M7	C-14 & M14	M7 & M14
1	Lactate	8.92	0.8936±0.5481	2.7188±0.5626 ↑	3.1448±0.5896	4.4874±0.7396 ↑↑	0.0001	0.0001	—
2	Urea	15.74	1.8223±1.2179	3.0323±0.9249 ↑	1.3401±0.3974	2.4959±0.8424 ↑↑	0.04	0.0009	0.1
	Phosphate	16.03	0.7812±0.1804	2.0260±1.3634 ↑	0.4436±0.0998	0.8301±0.0066 ↑↑	0.04	0.001	—
4	L-Threonine	16.44	0.1151±0.0462	0.1851±0.0322 ↑	0.1081±0.0168	0.1584±0.0365 ↑↑	0.007	0.0009	0.08
5	Glycine	16.65	0.0311±0.0127	0.0818±0.0380 ↑	0.0472±0.0316	0.0917±0.0666 ↑↑	0.01	0.04	0.4
6	Succinate	16.96	0.0087±0.0018	0.0622±0.0099 ↑	0.0077±0.0013	0.0139±0.0049 ↑↑	2×10 ⁻⁵	0.002	1×10 ⁻⁵
7	L-glyceric acid	17.25	0.0064±0.0023	0.0159±0.0061 ↑	0.0110±0.0021	0.0181±0.0035 ↑↑	0.005	4×10 ⁻⁵	—
8	4-Deoxyerythro nic acid	17.49	0.0091±0.0014	0.0107±0.0032	0.0079±0.0010	0.0126±0.0033 ↑↑	0.1	0.0006	0.1
9	2,4-Dihydroxy- butanoic acid	18.81	0.0033±0.0007	0.0047±0.0012 ↑	0.0042±0.0008	0.0066±0.0013 ↑↑	0.02	7×10 ⁻⁵	—
10	Aminomalonic acid	19.74	0.0150±0.0078	0.0185±0.0065	0.0112±0.0037	0.0158±0.0054 ↑↑	0.2	0.02	0.2
11	Malate	20.04	0.0151±0.0042	0.0276±0.0056 ↑	0.0152±0.0018	0.0198±0.0069 ↑↑	0.0008	0.03	0.01
12	2,3,4-Trihydrox y-butanal	20.28	0.0156±0.0021	0.0222±0.0054 ↑	0.0164±0.0038	0.0292±0.0035 ↑↑	0.02	8×10 ⁻⁸	0.01
13	5-Oxoproline	20.54	0.2623±0.1366	0.5353±0.1246 ↑	0.2715±0.0620	0.3719±0.0597 ↑↑	0.002	0.0006	0.01
14	Phenylalanine	21.02	0.0081±0.0023	0.0121±0.0038 ↑	0.0145±0.0039	0.0308±0.0096 ↑↑	0.03	0.0002	—
15	L-Proline	21.38	0.0183±0.0095	0.0271±0.0093	0.0237±0.0175	0.0483±0.0177 ↑↑	0.07	0.002	0.004
16	Glycerol 3-phosphate	23.55	0.0095±0.0039	0.0186±0.0042 ↑	0.0145±0.0045	0.0170±0.0078 ↑↑	0.002	0.2	—
17	D-Glucitol	26.20	0.0078±0.0008	0.0161±0.0009 ↑	0.0217±0.0036	0.0331±0.0063 ↑↑	8×10 ⁻⁹	0.0001	—
18	Palmitate	28.41	0.0161±0.0066	0.0186±0.0057	0.0138±0.0036	0.0218±0.0105 ↑↑	0.2	0.02	0.2
19	Octadecanoate	32.15	0.0471±0.0152	0.0875±0.0098 ↑	0.0355±0.0079	0.0595±0.0145 ↑↑	0.0002	0.0002	0.0002
20	1-hexadecanoyl -glycerol	35.81	0.0167±0.0018	0.0215±0.0017 ↑	0.0024±0.0054	0.0421±0.0084 ↑↑	0.0005	2×10 ⁻⁵	—
21	1-Octadecanoyl -glycerol	37.40	0.0172±0.0035	0.0219±0.0031 ↑	0.0179±0.0040	0.0288±0.0068 ↑↑	0.02	0.0003	0.008
22	Vitamin E	40.50	0.0165±0.0060	0.0244±0.0070 ↑	0.0148±0.0048	0.0274±0.0059 ↑↑	0.03	2×10 ⁻⁵	0.2
23	Cholesterol	40.66	0.5191±0.1145	0.6741±0.1448 ↑	0.3785±0.0891	0.5912±0.0829 ↑↑	0.03	9×10 ⁻⁶	—
24	β-Sitosterol	42.98	0.0122±0.0033	0.0365±0.0152 ↑	0.0171±0.0052	0.0333±0.0069 ↑↑	0.005	7×10 ⁻⁶	—

* The value is demonstrated as mean±SD. **C-7**, control group 1 for 7 days (the ligation suture was placed in the heart, but without ligation, followed by sampling in the 7th day); **C-14**, control group 2 for 14 days; **MI-7**, myocardial infarction group 1 ligated for 7 days; **MI-14**, myocardial infarction group 2 ligated for 14 days. “—” means that the metabolite levels have significant changes (p≤0.05) between C-7 and C-14 groups, so it has no significance to compare their levels between **MI-7 and MI-14 groups**. “↑” and “↑↑” demonstrate that the metabolite levels have significant elevation (p≤0.05) in MI-7 groups and MI-14 groups, comparing to C-7 and C-14, respectively.

Figure S1 a

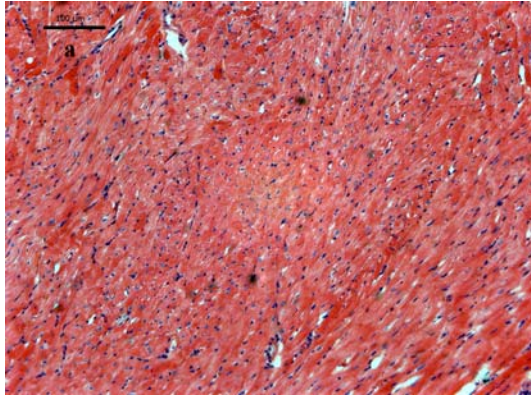


Figure S1 b

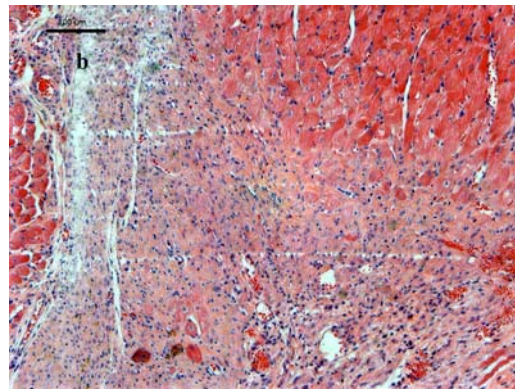


Figure S1 c

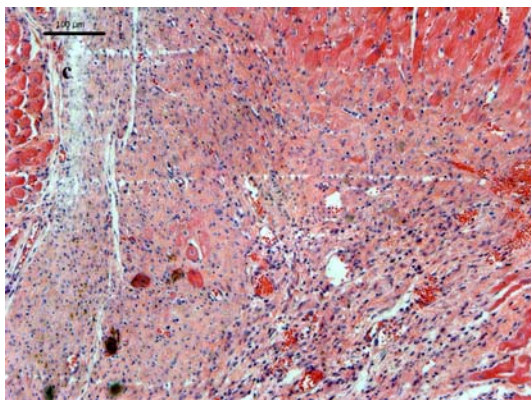


Figure S1 d

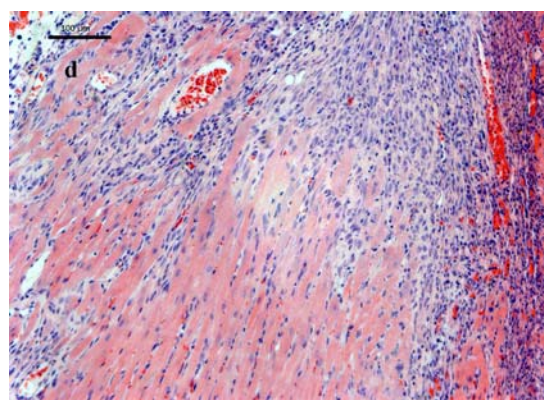


Figure S1. Histological change in myocardium following LAD ligation (200×). Myocardial tissues from rats in C-7 group (a) , MI-7 group (b), MI-14 group (c), and MI-7+ROE group (d) were processed and stained with HE. Compared to the normal heart tissue, inflammatory cell infiltration and contraction band necrosis (not shown) were the major features of the operated animals following LAD ligation