

Table 1. Baseline characteristics of patients with ACS in each three groups according to tertile value of serum MDA-LDL levels (main study).

	All (n=370)	Lowest MDA-LDL group (≤118 U/L) (n=124)	Middle MDA-LDL group (119-160 U/L) (n=123)	Highest MDA-LDL group (≥161 U/L) (n=123)	<i>p</i> -value
Clinical characteristics					
Age, years	71±11	75±10	71±11	66±12 ^{ab}	<0.001
Male sex, n (%)	282 (76)	94 (76)	91 (74)	97 (79)	0.662
Body mass index, kg/m ²	23.4±3.4	22.6±3.2	23.8±3.5	23.9±3.4 ^a	0.003
Hypertension, n (%)	249 (67)	90 (73)	84 (68)	75 (61)	0.145
Diabetes mellitus, n (%)	123 (33)	43 (35)	44 (36)	36 (29)	0.510
Dyslipidemia, n (%)	224 (61)	57 (46)	76 (62)	91 (74) ^{ab}	<0.001
Smoking, n (%)	194 (52)	59 (48)	58 (47)	77 (63) ^{ab}	0.022
Previous PCI, n (%)	46 (12)	16 (13)	16 (13)	14 (11)	0.911
Previous CABG, n (%)	3 (1)	2 (2)	1 (1)	0 (0)	0.369
Type of acute coronary syndrome					
Acute myocardial infarction, n (%)	264 (71)	79 (64)	86 (70)	99 (80) ^a	0.001

Unstable angina pectoris, n (%)	106 (29)	45 (36)	37 (30)	24 (20) ^a	0.001
Angiographic characteristics					
Multi-vessel disease, n (%)	164 (44)	47 (38)	55 (45)	62 (50)	0.141
Infarct-related artery					
Right, n (%)	136 (37)	41 (33)	51 (41)	44 (36)	0.377
Left anterior descending, n (%)	184 (50)	69 (56)	51 (41)	64 (52)	0.069
Left circumflex, n (%)	45 (12)	13 (10)	18 (14)	14 (11)	0.577
Left main trunk, n (%)	5 (1)	1 (1)	3 (2)	1 (1)	0.442
% stenosis of target lesion					
90%, n (%)	105 (28)	43 (35)	37 (30)	25 (20) ^a	0.038
99%, n (%)	117 (32)	36 (29)	38 (31)	43 (35)	0.592
100%, n (%)	148 (40)	45 (36)	48 (39)	55 (45)	0.387
TIMI grade of pre-PCI					
0, n (%)	147 (40)	44 (36)	48 (39)	55 (45)	0.327
I, n (%)	28 (8)	8 (7)	10 (8)	10 (8)	0.847
II, n (%)	90 (24)	29 (23)	28 (23)	33 (27)	0.726
III, n (%)	105 (28)	43 (35)	37 (30)	25 (20) ^a	0.038
Stent use, n (%)	362(98)	119 (96)	122(99)	121 (98)	0.194
Bare metal stent, n (%)	153 (41)	49 (40)	48 (39)	56 (46)	0.514

Drug eluting stent, n (%)	209 (56)	70 (56)	74 (60)	65 (53)	0.512
Follow up coronary angiography, n (%)	232 (63)	77 (62)	76 (62)	79 (64)	0.911
Biochemical data					
Total cholesterol, mg/dl	196±36	170±35	194±33	222±40 ^{ab}	<0.001
Triglyceride, mg/dl	110 (69-164)	89 (55.8-130)	110 (69-149)	136 (96-210) ^{ab}	<0.001
LDL-C, mg/dl	120±33	98±31	119±31	143±38 ^{ab}	<0.001
HDL-C, mg/dl	49±14	52±14	49±14	47±14 ^a	0.023
LDL-C / HDL-C ratio	2.6±0.9	2.0±0.8	2.6±0.9	3.2±1.0 ^{ab}	<0.001
MDA-LDL, U/L	150±37	93±18	138±11	221±60 ^{ab}	<0.001
MDA-LDL/LDL-C ratio	1.3±0.5	1.0±0.4	1.3±0.5	1.6±0.6 ^{ab}	<0.001
Hemoglobin A1c, %	6.3±1.2	6.2±1.1	6.4±1.4	6.2±1.3	0.349
Brain natriuretic peptide, pg/dl	79 (20-212)	117 (29-362)	40 (16-126)	68 (16-212)	0.047
Peak CPK, IU/L	1684 (522-3432)	913 (365-2500)	1797 (688-3575)	2019 (733-5270) ^a	<0.001
Peak CK-MB, IU/L	74 (17-250)	36 (13-150)	86 (17-248)	125 (32-355) ^a	0.004
eGFR, ml · min ⁻¹ · 1.73 m ⁻²	54±19	52±19	52±19	59±18 ^{ab}	0.006
Medications on admission					
Aspirin, n (%)	81 (22)	35 (28)	26 (21)	20 (16)	0.073
Clopidogrel, n (%)	49 (13)	19 (15)	15 (12)	15 (12)	0.704
ACEI, n (%)	19 (5)	7 (6)	7 (6)	5 (4)	0.805

ARB, n (%)	113 (31)	41 (33)	42 (34)	30 (24)	0.190
Beta-blocker, n (%)	36 (10)	14 (11)	16(13)	6 (5)	0.076
Statin, n (%)	76 (21)	29 (23)	31 (25)	16 (13) ^{ab}	0.038
Insulin, n (%)	17 (5)	4 (3)	10(8)	3 (2)	0.069
Oral hypoglycemic agent, n (%)	67 (18)	25 (20)	23 (9)	19 (15)	0.616

Values are expressed as mean \pm standard deviation, median and interquartile range, or absolute number of cases (relative percentage) as appropriate. ACEI = angiotensin-converting enzyme inhibitor; ACS = acute coronary syndrome; ARB = angiotensin II receptor blocker; CABG = coronary artery bypass grafting; CK-MB = creatine kinase MB; CPK = creatine phosphokinase; eGFR = estimated glomerular filtration rate; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; MDA-LDL = malondialdehyde-modified low-density lipoprotein; PCI = percutaneous coronary intervention.

^a $p < 0.05$ vs the lowest group; ^b $p < 0.05$ vs the middle group.

Table 2. Comparison of clinical events among three groups according to serum MDA-LDL levels in patients with ACS (main study).

	All (n=370)	Lowest MDA-LDL group (≤118 U/L) (n=124)	Middle MDA-LDL group (119-160 U/L) (n=123)	Highest MDA-LDL group (≥161 U/L) (n=123)	<i>p</i> -value
MACCE (all cause), n (%)	82 (22)	12 (10)	30 (24)	40 (33)	<0.001
Cardiovascular death, n (%)	11 (3)	1 (1)	5 (4)	5 (4)	0.219
Non-fatal myocardial infarction, n (%)	6 (2)	2 (2)	1 (1)	3 (2)	0.601
Non-fatal stroke, n (%)	6 (2)	3 (2)	2 (2)	1 (1)	0.607
Revascularization (%)	49 (13)	3 (2)	17 (14)	29 (24)	<0.001
Heart failure requiring hospital admission, n (%)	10 (3)	3 (2)	5 (4)	2 (2)	0.485

Values are expressed as absolute number of events (relative percentage). ACS = acute coronary syndrome; MACCE = major adverse cardiovascular and cerebral events; MDA-LDL = malondialdehyde-modified low-density lipoprotein.

Table 3. Hazard ratios of MACCE for each 1 SD increase of serum MDA-LDL values in patients with ACS (main study).

	Model 1		Model 2		Model 3		Model 4	
	HR (95%CI)	p-value	HR (95%CI)	p-value	HR (95%CI)	p-value	HR (95%CI)	p-value
MDA-LDL, per 1 SD (37 U/L) increase	1.17 (1.06-1.27)	0.003	1.21 (1.08-1.34)	0.001	1.22 (1.06-1.39)	0.007	1.80 (1.07-3.16)	0.027

Model 1: unadjusted.

Model 2: adjusted for age, sex, hypertension, dyslipidemia, diabetes mellitus, smoking, and body mass index.

Model 3: adjusted for total cholesterol (per 1 SD [36 mg/dl] increase), triglycerides (*), low-density lipoprotein cholesterol (per 1 SD [33 mg/dl] increase), high-density lipoprotein cholesterol (per 1 SD [14 mg/dl] increase), and statin use (on admission), in addition to model 2.

Model 4: adjusted for peak creatine phosphokinase (*), brain natriuretic peptide (*), and presence or absence of multivessel disease, in addition to model 3.

* per 1 increase in logarithmic transformed number

CI = confidence interval; HR = hazard ratio; MACCE = major adverse cardiovascular and cerebral events; MDA-LDL = malondialdehyde-modified low-density lipoprotein; SD = standard deviation.

Table 4. Baseline characteristics of patients with AMI in each two groups according to median value of serum MDA-LDL levels (sub-study).

	All patients with acute myocardial infarction (n=264)	Lower MDA-LDL group (≤ 141 U/L) (n=130)	Higher MDA-LDL group (≥ 142 U/L) (n=134)	<i>p</i> -value
Clinical characteristics				
Age, years	71 \pm 12	74 \pm 11	68 \pm 11	<0.001
Male sex, n (%)	197 (75)	92 (71)	105 (78)	0.157
Body mass index, kg/m ²	23.2 \pm 3.4	22.7 \pm 3.5	23.7 \pm 3.3	0.015
Hypertension, n (%)	163 (62)	78 (60)	85 (63)	0.566
Diabetes mellitus, n (%)	81 (31)	42 (32)	39 (29)	0.573
Dyslipidemia, n (%)	158 (60)	61 (47)	97 (72)	<0.001
Smoking, n (%)	143 (54)	67 (52)	76 (57)	0.399
Previous PCI, n (%)	26 (10)	13 (10)	13 (10)	0.935
Previous CABG, n (%)	2 (1)	1 (1)	1 (1)	0.979
Type of acute myocardial infarction				

STEMI, n (%)	190 (72)	89 (68)	101 (75)	0.211
NSTEMI, n (%)	74 (28)	41 (32)	33 (25)	0.211
Angiographic characteristics				
Multi-vessel disease, n (%)	119 (45)	46 (35)	73 (54)	0.002
Infarct-related artery				
Right, n (%)	98 (37)	46 (35)	52 (39)	0.565
Left anterior descending, n (%)	127 (48)	60 (46)	67 (59)	0.532
Left circumflex, n (%)	35 (13)	22 (17)	13 (10)	0.084
Left main trunk, n (%)	4 (2)	2 (2)	2 (1)	0.976
% stenosis of target lesion				
90%, n (%)	47 (18)	28 (22)	19 (14)	0.118
99%, n (%)	83 (31)	40 (31)	43 (32)	0.817
100%, n (%)	134 (51)	62 (48)	72 (54)	0.327
TIMI grade of pre-PCI				
0, n (%)	133 (50)	61 (47)	72 (54)	0.269
I, n (%)	18 (7)	6 (5)	12 (9)	0.162
II, n (%)	66 (25)	35 (27)	31 (23)	0.477
III, n (%)	47 (18)	28 (22)	19 (14)	0.118
Stent use, n (%)	258 (98)	125 (96)	133 (99)	0.091

Bare metal stent, n (%)	122 (46)	59 (45)	63 (47)	0.791
Drug eluting stent, n (%)	128 (49)	66 (51)	70 (52)	0.811
Follow up coronary angiography, n (%)	169 (64)	83 (64)	86 (64)	0.955
Biochemical data				
Total cholesterol, mg/dl	199±44	181±38	217±41	<0.001
Triglyceride, mg/dl	104 (69-160)	87 (58-127)	126 (91-200)	<0.001
LDL-C, mg/dl	124±40	109±34	138±40	<0.001
HDL-C, mg/dl	50±14	52±14	48±14	0.059
LDL-C / HDL-C ratio	2.6±1.0	2.3±0.9	3.0±1.0	<0.001
MDA-LDL, U/L	157±69	107±24	206±63	<0.001
MDA-LDL/LDL-C ratio	1.3±0.6	1.0±0.4	1.6±0.7	<0.001
Hemoglobin A1c, %	6.3±1.2	6.2±1.2	6.3±1.2	0.741
Brain natriuretic peptide, pg/dl	111 (25-308)	162 (43-403)	41 (13-226)	0.028
Peak CPK, IU/L	1692 (526-3451)	1035 (411-2880)	2105 (787-4554)	<0.001
Peak CK-MB, IU/L	151 (44-320)	101 (36-276)	195 (81-377)	<0.001
eGFR, ml · min ⁻¹ · 1.73 m ⁻²	55±19	54±19	56±18	0.369
Medications on admission				
Aspirin, n (%)	39 (15)	20 (15)	19 (14)	0.783
Clopidogrel, n (%)	15 (6)	10 (8)	5 (4)	0.165

ACEI, n (%)	12 (5)	6 (5)	6 (4)	0.957
ARB, n (%)	73 (28)	37 (28)	36 (27)	0.772
Beta-blocker, n (%)	17 (6)	7 (5)	10 (7)	0.492
Statin, n (%)	45 (17)	27 (21)	18 (13)	0.113
Insulin, n (%)	9 (3)	5 (4)	4 (3)	0.700
Oral hypoglycemic agent, n (%)	42 (16)	23 (18)	19 (14)	0.435

Values are expressed as mean \pm standard deviation, median and interquartile range, or absolute number of cases (relative percentage) as appropriate. ACEI = angiotensin-converting enzyme inhibitor; ACS = acute coronary syndrome; ARB = angiotensin II receptor blocker; CABG = coronary artery bypass grafting; CK-MB = creatine kinase MB; CPK = creatine phosphokinase; eGFR = estimated glomerular filtration rate; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; MDA-LDL = malondialdehyde-modified low-density lipoprotein; NSTEMI = non-ST-elevation myocardial infarction; PCI = percutaneous coronary intervention; STEMI = ST-elevation myocardial infarction.

^a $p < 0.05$ vs the lowest group; ^b $p < 0.05$ vs the middle group.

Table 5. Hazard ratios of MACCE for each 1 SD increase of serum MDA-LDL values in patients with AMI (sub-study).

	Model 1		Model 2		Model 3		Model 4	
	HR (95%CI)	p-value	HR (95%CI)	p-value	HR (95%CI)	p-value	HR (95%CI)	p-value
MDA-LDL, per 1 SD (69 U/L) increase	1.29 (1.04-1.56)	0.021	1.34 (1.04-1.69)	0.023	1.41 (1.04-1.89)	0.025	3.50 (1.27-10.5)	0.016

Model 1: unadjusted.

Model 2: adjusted for age, sex, hypertension, dyslipidemia, diabetes mellitus, smoking, and body mass index.

Model 3: adjusted for total cholesterol (per 1 SD [44 mg/dl] increase), triglycerides (*), low-density lipoprotein cholesterol (per 1 SD [40 mg/dl] increase), high-density lipoprotein cholesterol (per 1 SD [14 mg/dl] increase), and statin use (on admission), in addition to model 2.

Model 4: adjusted for peak creatine phosphokinase (*), brain natriuretic peptide (*), and presence or absence of multivessel disease, in addition to model 3.

* per 1 increase in logarithmic transformed number

AMI = acute myocardial infarction; CI = confidence interval; HR = hazard ratio; MACCE = major adverse cardiovascular and cerebral events; MDA-LDL = malondialdehyde-modified low-density lipoprotein; SD = standard deviation.

