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Original article

“30-minute-delta” of high-sensitivity troponin I improves diagnostic performance in acute myocardial infarction

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INTRODUCTION:

- Acute myocardial infarction (AMI) is a major cause of mortality and morbidity worldwide. Patients with suspected AMI must be evaluated immediately to identify life-threatening emergencies.
- The universal definition of MI is based on rise of cardiac biomarkers such as cardiac troponin (cTn) with symptoms and/or ST-T changes on electrocardiogram (ECG) suggestive of myocardial ischemia



- The American College of Cardiology/American Heart Association non-ST segment elevation acute coronary syndrome (NSTEMI-ACS) guidelines in 2014 recommend that cTn should be measured on first assessment and repeatedly 3–6 h later
- Delta measurements performed within a time interval shorter than 1 h are expected to provide more efficient AMI diagnoses.
- the aim of this study was to evaluate the diagnostic performance of thirty-minute serial measurements of hs-cTnI for the detection of AMI.



METHODS

- We prospectively enrolled 71 consecutive patients presenting to the Hirosaki University Hospital between May 2015 and January 2016 with symptoms suggestive of AMI within 12 h from onset.
- A clinical assessment was performed for all patients including history taking, physical examinations, ECG, laboratory test, echocardiography, and coronary angiography.



RESULTS

Table 1
Baseline characteristics of the study patients.

	All (n=71)	AMI (n=55)	Non-AMI (n=16)	p-Value
Age, years	68 ± 13	67 ± 13	71 ± 10	0.26
Male gender, n (%)	48 (68)	42 (76)	6 (38)	<0.01 *
BMI, kg/m ²	24.3 ± 3.5	24.3 ± 3.2	24.4 ± 4.3	0.89
Risk factors, n (%)				
Hypertension	52 (73)	43 (78)	9 (56)	0.11
Dyslipidemia	49 (69)	38 (69)	11 (69)	1.00
Diabetes mellitus	28 (39)	19 (35)	9 (56)	0.15
Smoking	46 (65)	39 (71)	7 (44)	0.07
Prior history, n (%)				
MI	9 (13)	5 (9)	4 (25)	0.11
PCI	8 (11)	4 (7)	4 (25)	0.07
CABG	2 (3)	2 (4)	0 (0)	1.00
Stroke	7 (10)	6 (11)	1 (6)	1.00
PAD	4 (6)	3 (5)	1 (6)	1.00
Blood chemistry at presentation				
Total-cholesterol, mg/dL	199 ± 44	201 ± 42	192 ± 52	0.50
Triglyceride, mg/dL	131 ± 94	131 ± 103	133 ± 59	0.94
LDL-cholesterol, mg/dL	127 ± 39	129 ± 36	120 ± 50	0.47
HDL-cholesterol, mg/dL	46 ± 11	46 ± 12	45 ± 10	0.78
Admission glucose, mg/dL	159 ± 54	155 ± 45	172 ± 76	0.26
HbA1c, %	6.1 ± 0.8	6.1 ± 0.8	6.3 ± 0.8	0.45
BNP, pg/mL	38 [15–110]	36 [15–85]	45 [15–320]	0.45
ECG at presentation, n (%)				
ST-segment elevation	46 (65)	46 (84)	1 (6)	<0.01 *
ST-segment depression	13 (18)	8 (15)	5 (31)	0.15
T-wave inversion	11 (15)	3 (5)	8 (50)	<0.01 *
Left bundle branch block	0 (0)	0 (0)	0 (0)	1.0
Pacemaker rhythm	2 (3)	0 (0)	2 (13)	<0.05
LVEF at presentation, %	48.4 ± 12.2	45.4 ± 10.4	58.9 ± 12.4	<0.01 *
Time to 1st sampling, min	210 [137–364]	205 [140–364]	274 [105–378]	0.90
eGFR, mL/min/1.73 m ²	68.9 ± 20.6	69.3 ± 20.6	67.6 ± 21.4	0.78

Data are shown as mean ± standard deviation (SD), median (25th–75th percentiles), or n (%).

AMI, acute myocardial infarction; BMI, body mass index; BNP, brain natriuretic peptide; CABG, coronary artery bypass grafting; ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; LDL, low-density lipoprotein; LVEF, left ventricular ejection fraction; MI, myocardial infarction; PAD, peripheral artery disease; PCI, percutaneous coronary intervention.

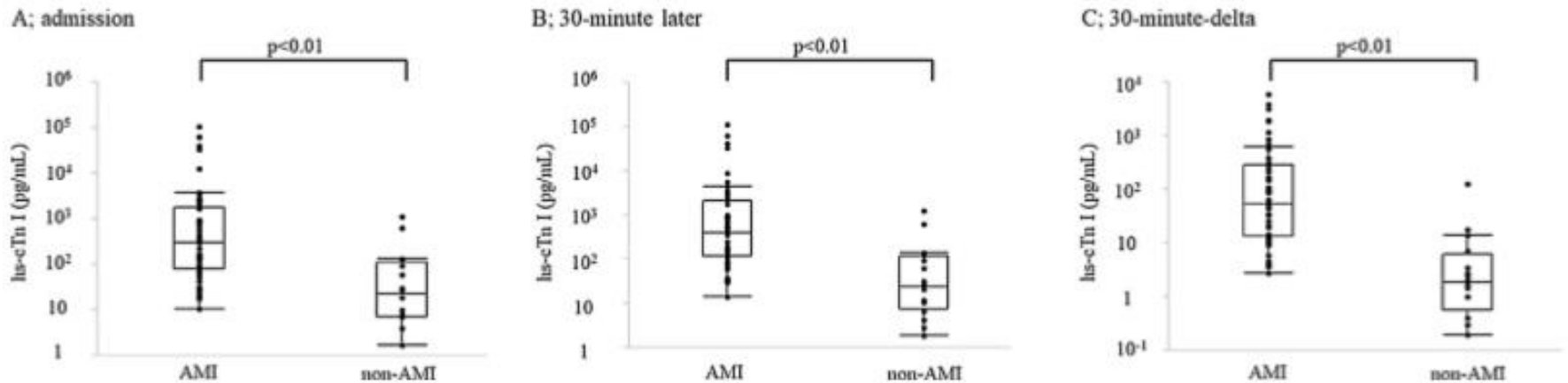


Fig. 1. Comparison of high-sensitivity cardiac troponin I (hs-cTnI) levels between AMI patients and non-AMI patients. (A) hs-cTnI levels at presentation. (B) Hs-cTnI levels 30 min after presentation. (C) “30-minute-delta” of hs-cTnI.

- The hs-cTnI levels at presentation were significantly higher in the AMI group than in the non-AMI group. Furthermore, the hs-cTnI levels at 30 min after presentation were also significantly higher in the AMI group than in the non-AMI. The “30-minute-delta,” a difference between 1st and 2nd hs-cTnI values, was significantly higher in the AMI group than in the non-AMI group



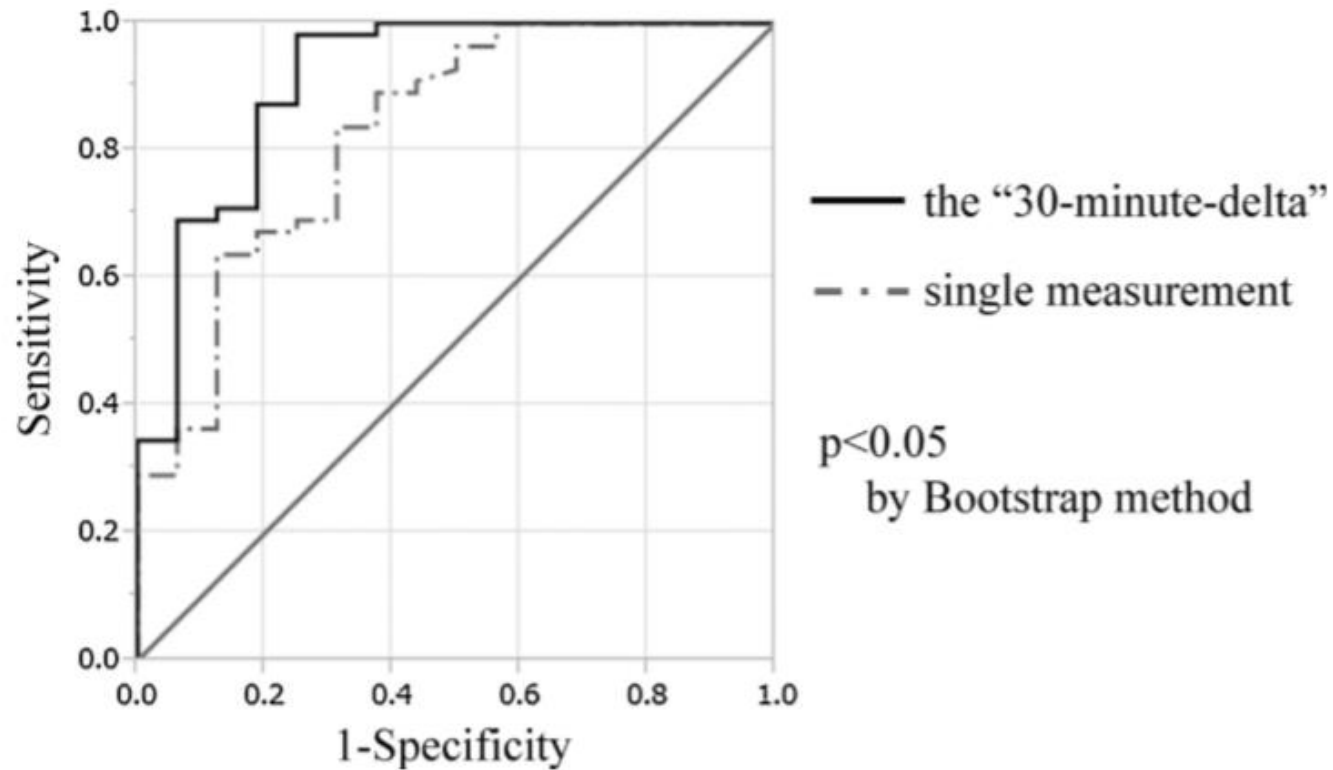


Fig. 2. Comparison of receiver operating characteristic (ROC) curves between “30-minute-delta” and the 1st high-sensitivity cardiac troponin I (hs-cTnI) value at presentation. The black line indicates the ROC curve for the delta measurement of hs-cTnI, whereas the dotted line indicates the ROC curve for a single measurement of hs-cTnI at presentation. The difference between the two areas under the curve was significant according to the bootstrap method ($p < 0.05$).



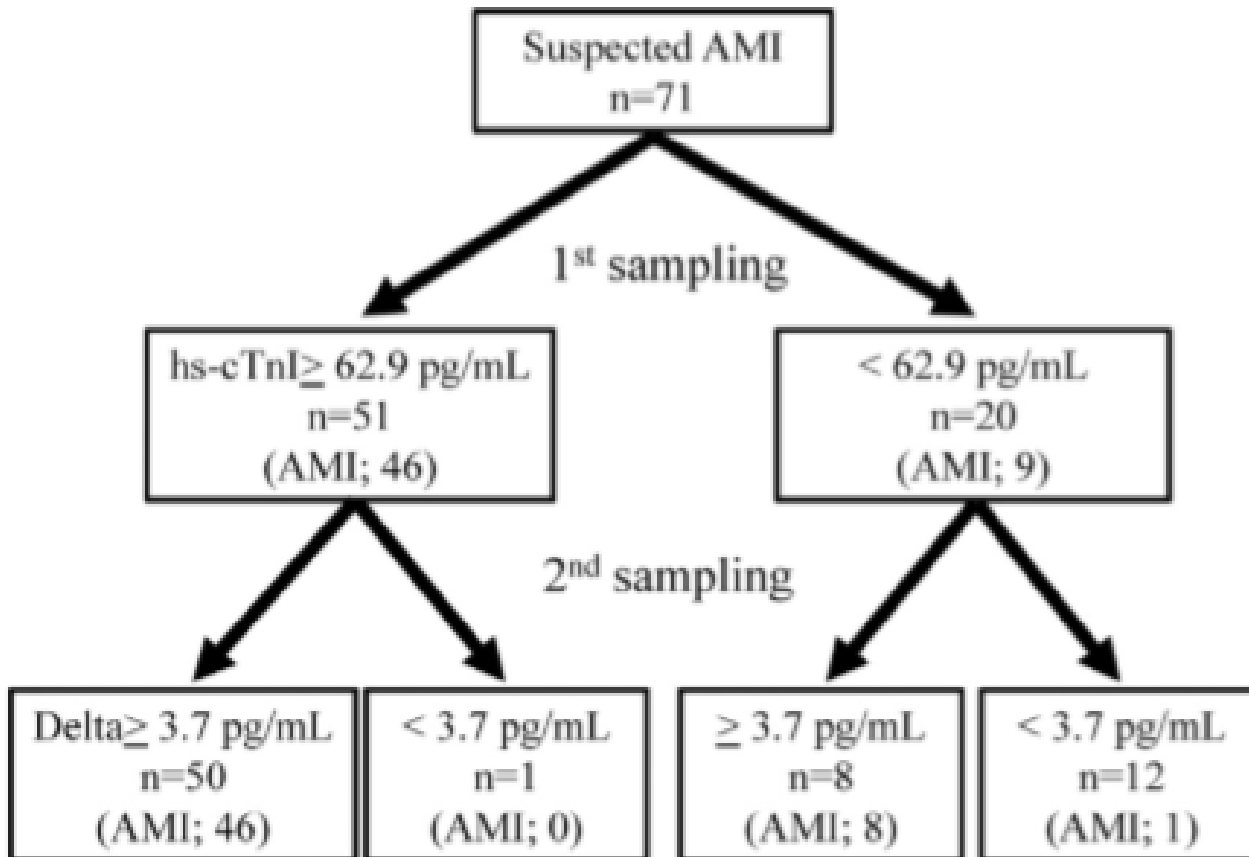


Fig. 3. The “30-minute-delta” algorithm for the diagnosis of acute myocardial infarction (AMI) according to our results. Delta indicates a difference between 1st and 2nd high-sensitivity cardiac troponin I (hs-cTnI) values.



CONCLUSION:

- The “30-minute-delta” of hs-cTnI improves the early diagnostic performance of AMI detection compared with the use of 1st hscTnI value at presentation. The “30-minute-delta” approach may lead to the earlier initiation of effective medical treatment aimed at better prognosis for AMI patients and contribute to reduction of unnecessary examinations.

