Association between serum NT-pro BNP level and coronary plaque characteristics detected by coronary CT angiography in patients with UA

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Aims and objectives

B-type natriuretic peptide (BNP) is predominantly secreted by ventricular cardiomyocytes and particularly in patients with chronic cardiac disease. It plays a key role in regulation of circulation and balance of water-electrolyte, and it closely associated with systolic and diastolic function of myocardial cell. Today BNP is considered as an effective index of evaluation of myocardial function. Level of serum N-terminal pro B-type natriuretic peptide (NT-pro BNP) is closely associated with BNP, and it is stable enough to be detected in laboratory. Study revealed that level of serum NT-pro BNP is related with severity and prognosis of coronary artery atherosclerotic disease. At present, coronary CT angiography (CCTA) is widely used to evaluate the burden and stability of coronary atherosclerosis plaque in patient with unstable angina (UA). We design this study to explore the association between level of serum NT-pro BNP and characteristics of atherosclerotic plaque detected by CCTA in patients with UA.
Methods and materials

we prospectively collected 102 case (47-82 year-old, mean age was 74.5; male to female ratio was 1.8:1) from Jan 2013 to Jan 2014 in our hospital. Informed consent form were signed before blood drawing for detection of serum NT-pro BNP. Inclusive criteria: patient with proven stable angina pectoris (SAP) and UA according to ACCF/AHA guideline of management of acute coronary syndrome. Exclusive criteria: acute myocardial infarction, cardiomyopathy, valvular disease, cardiac dysfunction, coronary revascularization (i.e. PCI, stent, and coronary artery bypass grafting), renal insufficiency, allergic to iodine, bad tolerance to CCTA examination, and pregnant women and minors. All subjects finished examination of CCTA and detection of serum NT-pro BNP within 12-48 hours after onset of illness. Grouping: patients with UA (48 cases) were analyzed as experimental group, and patients with SAP (27 cases) and non-cardiac disease (27 cases) were analyzed as control groups. Scan protocol and image reconstruction # All scans were performed according to SCCT guidelines for the performance of CCTA with a multidetector CT scanner (256iCT Philips). Helical scan data were obtained with retrospective or prospective electrocardiographic gating. During CCTA acquisition, 50-60ml iodinated contrast (370mgI/ml, Bayer Schering pharmaceutical industry, Deutschland) was injected followed by a 35-40 ml saline flush (4.5-5ml/s). Threshold tract trigger mode of ROI was adopted.[6] The images were evaluated on transaxial 2-dimensional image stacks (raw data), multiplanar reformations (MPRs), maximum intensity projections (MIPs), curved multiplanar reformations (cMPRs), and volume-rendering (VR) technique reconstructions reviews. If a coronary artery segment was uninterpretable, the case was ruled out. Laboratory examination: Fasting blood samples (4.0ml) were collected using vacuum tube and the serums were separated 30 minutes later. Automatic biochemical analyzer 7600DDP (Hitachi, Japan) was used for detection. Statistical analysis: Patient's demographic characteristics were presented as means ± SD or as medians (i.e. interquartile ranges) for continuous variables, and as proportions (i.e. percentages) for categorical variables. Level of serum NT-pro BNP presented approximately normal distribution with logarithmic transformation. Non-parametric Mann-Whitney or Kruskal-Wallis tests were used to compare continuous variables, and Chi-square test was used to evaluate differences in frequencies. Correlations between variables were analyzed with linear and binary logistic regression model. Receiver-Operating Characteristic (ROC) curve analyses were used to evaluate the authenticity and reliability of our study, and to estimate optimal threshold. Statistical comparisons were performed with SPSS 19.0 for Windows. Comparisons were considered significant for a two-tailed P-value <0.05.
Results

Correlation analysis between level of serum NT-pro BNP and characteristics of atherosclerotic plaque detected by CCTA in patients with UA. In UA group, log(NT-pro BNP) had various degree of linear correlation with number of involved vessels \((r=0.462, P=0.000)\), SIS \((r=0.475, P=0.000)\), SSS \((r=0.453, P=0.000)\), CCS \((r=0.412, P=0.001)\), number of involved segments of non-calcified plaques \((r=0.235, P=0.017)\), mixed plaques \((r=0.234, P=0.017)\), and calcified plaques \((r=0.431, P=0.000)\); number of obstructive disease \((r=0.346, P=0.000)\). But after adjusting some confounding factors, log (NT-pro BNP) was not the independent risk factor of UA. There were significant differences among three groups in LM-LAD disease. LM and LAD were the most common vessels involved in patients with UA, \(#^2 = 21.444, P=0.000\). Level of serum NT-pro BNP was significantly higher in LM-LAD disease than in non-LM-LAD disease in patients with UA \((2.12\pm 0.52 \text{ vs. } 1.64\pm 0.48, P=0.000)\). (figure 1) There were significant differences among three groups in number of obstructive disease. UA group had the severest obstructive disease, \(#^2 = 10.113, P=0.006\). Level of serum N-pro BNP in obstructive disease group was significantly higher than in non-obstructive disease group in patients with UA \((1.78\pm 0.49 \text{ vs. } 2.22\pm 0.54, P=0.000)\), and the level of serum N-pro BNP increased with increasing number of obstructive vessels \((P=0.4)\). With SAP and non-cardiac disease groups as control group, ROC curves were plotted. (figure 3) For patients with UA, AUC was 0.656, 95%CI was 0.55-0.762, \(P=0.006\); optimal cut-off value was 1.74, and sensitivity, specificity, \(LR^+, LR^-\), OR and kappa value were 77.6%, 51.9%, 1.61, 0.43, 0.3, 3.841.
Fig. 1: There were significant differences among three groups in LM-LAD disease. LM and LAD were the most common vessels involved in patients with UA.

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Fig. 2: There were significant differences among three groups in number of obstructive disease. UA group had the severest obstructive disease.

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**Fig. 3:** With SAP and non-cardiac disease groups as control group, ROC curves were plotted. For patients with UA, AUC was 0.656.

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Conclusion

Level of serum of NT-pro BNP had significant association with characteristics of coronary atherosclerotic plaques detected by CCTA, which included that extent of lesion, degree of luminal stenosis, calcified plaque, and had important clinical significance in diagnosis of UA.
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