# Methods to increase clinical applicability of heart rate variability analysis for noninvasive detecting severity of coronary lesions in patients with coronary heart disease

To the Editor,

Recently, Feng et al. (1) published an article entitled "Altered heart rate variability depends on the characteristics of coronary lesions instable angina pectoris" in Anatol J Cardiol, where they have shown that the parameters of heart rate variability (HRV) are associated with the severity of coronary lesions in patients with stable angina pectoris. Noninvasive detecting the severity of coronary lesions in patients with coronary heart disease (CHD) including stable angina pectoris is a very important problem. The authors have used time domain parameters and have not used frequency-domain indices in their study (1). However, the time and frequency domain indices of HRV complement each other for heart autonomic control assessment (2). The absence of analysis of frequency domain indices restricts the interpretation of results of the study. In addition, the authors have not provided any information on duration and other parameters of electrocardiogram (ECG) recording used in their analysis of HRV.

Feng et al. (1) revealed statistically significant differences between the patients with different severity of coronary lesions. However, despite statistical significance of these differences, the group distributions of HRV parameters in their tables 3-5 substantially overlap with each other. This reduces the clinical applicability of the study results. The clinical applicability can be improved by using various autonomic parameters and different functional tests (load test, breathing test, etc.). In our study (3), we studied the frequency estimates of HRV in the low and high frequency spectral bands in CHD patients with different severity of coronary lesion during bicycle exercise test. We have revealed the static differences between the patients with different coronary lesion that agree in general with Feng et al. (1) and have shown the adaptation potential of heart autonomic control in these patients (3). Similar approach can be used to improve the clinical reliability of load test (4), which is often used in patients with coronary lesions (5).

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## References

1. Feng J, Wang A, Gao C, Zhang J, Chen Z, Hou L, et al. Altered heart rate variability depends on the characteristics of coronary lesions instable angina pectoris. Anatol J Cardiol 2014 July 17 Epub ahead of print.
2. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. Circulation 1996; 93: 1043-65. **[CrossRef]**
3. Kiselev AR, Gridnev VI, Posnenkova OM, Strunina AN, Shvarts VA, Dovgalevskii Ya P. Changes in the power of the low- and high-frequency bands of the heart rate variability spectrum in coronary heart disease patients with different severities of coronary atherosclerosis in the course of load tests. Fiziol Cheloveka 2008; 34: 57-64. **[CrossRef]**
4. Gridnev VI, Kiselev AR, Posnenkova OM, Shvartz VA. Using of spectral analysis of heart rate variability for increasing reliability of bicycle ergometry results. Health 2011; 3: 477-81. **[CrossRef]**
5. Mao L, Li X, Zhong L, Wei S. The value of exercise treadmill test in evaluation of coronary artery disease. Russian Open Medical J 2012; 1: 0306. **[CrossRef]**

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## Author`s Reply

To the Editor,

Thank you for this letter regarding our paper entitled "Altered heart rate variability depends on the characteristics of coronary lesions instable angina pectoris." published in this issue (1).

HRV analysis method is still developing constantly, generally including three methods: time domain analysis, frequency domain analysis, and nonlinear analysis. Time and frequency domain analyses are widely applied in clinical practice. The time domain measure is the original and simplest method for deriving HRV but has low sensitivity and specificity (2). Frequency domain measure is also a classic analysis method. The analysis of its result is not of physiological significance and the defect cannot reflect the temporal characteristics of non-stationary signal. In addition, the specificity is not high.

According to the report of the Task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (3), using frequency domain measure, the analyzed ECG signals must satisfy several technical requirements to obtain reliable information. In several studies, authors have applied time and frequency domain parameters in their studies (4). Meanwhile, many studies have separately used time or frequency domain parameters in their studies (5). In our study (6), according to the related studies, we used time domain parameters, which is the original and simplest method to explore the relationship between HRV and severity of coronary lesions in patients with stable angina pectoris. Furthermore, we provided some information on the duration and parameters of ECG recording used in our analysis of HRV in text of method.

In our study (1), conclusion is that HRV may be playing a crucial role in estimating the correlation between the damage of coronary artery and dysfunction of autonomic nerve system. Similar to the vast majority of study results, it multicenter studies with a large sample size and to confirm the clinical application undoubtedly. In table 3, we have shown the correlation between coronary artery disease severity and HRV indicators. In table 4, we have shown the correlation between the number of coronary artery disease patients and HRV indicators. In table 5, we have shown the correlation between coronary artery lesion loca-

tions and HRV indicators. Sample sizes, Gensini scores, and different aspects differ in each table (4, 5). However, we are yet unclear regarding the views of them expressed in the letter that the group distributions of HRV parameters in tables 3-5 in our study substantially overlap with each other and reduce the clinical applicability of the study results.

We sincerely hope that these responses can answer their questions.

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### References

1. Feng J, Wang A, Gao C, Zhang J, Chen Z, Hou L, et al. Altered heart rate variability depends on the characteristics of coronary lesions in stable angina pectoris. Anatol J Cardiol 2014 Jul 17 Epub ahead of print.
2. Routledge FS, Campbell TS, McFetridge-Durdle JA, Bacon SL. Improvements in heart rate variability with exercise therapy. Can J Cardiol 2010; 26: 303-12. **[CrossRef]**
3. Heart rate variability. Standards of measurement, physiological interpretation and clinical use. Task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Eur Heart J 1996; 17: 354-81. **[CrossRef]**
4. Lanza GA, Sgueglia GA, Cianflone D, Rebuzzi AG, Angeloni G, Sestito A, et al. Relation of heart rate variability to serum levels of C-reactive protein in patients with unstable angina pectoris. Am J Cardiol 2006; 97: 1702-6. **[CrossRef]**
5. Von Känel R, Carney RM, Zhao S, Whooley MA. Heart rate variability and biomarkers of systemic inflammation in patients with stable coronary heart diseases: finding from the Heart and Soul Study. Clin Res Cardiol 2011; 100: 241-7. **[CrossRef]**

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# Obesity and coronary bypass

To the Editor,

We have read with great interest the article entitled "Obesity is still a risk factor in coronary artery bypass surgery" published in Anatol J Cardiol 2014; 14: 631-7 (1). The authors aimed to document the effects of obesity on surgical outcomes in patients undergoing coronary artery bypass surgery. They concluded that obesity was still a risk factor for occurrence of adverse events in cardiac surgery and the mortality rates were similar in obese and non-obese patients. We congratulate the authors for these valuable results.

There are several reports regarding the effect of obesity on postoperative mortality and morbidity after cardiac operations. Some of them concluded that obesity is a risk factor for both mortality and morbidity, and some concluded that obesity is a risk factor only for morbidity (2). This result is partially supported again with this article. However, the design of the article does not confirm the hypothesis of the manuscript because there is a statistical difference between the parameters which affect the operative mortality and morbidity, such as female gender,

smoking, diabetes mellitus, and hypertension; even the result of the article is compatible with the literature (Table 3). We expect equality between the parameters which affect the prognosis. We assume that obesity is a risk factor not only for morbidity but also for mortality after coronary bypass surgery and after many other operations. There is a need to more detailed studies about the clarification of this difference between obese patients.

Furthermore, postoperative atrial fibrillation is a common complication after cardiac surgery and predicts increased morbidity and mortality. There are many studies in the literature which propose that atrial fibrillation is a risk factor for obese patients compared with that for non-obese patients (3). We believe that mortality resulting from obesity disagree with the results of postoperative atrial fibrillation which is more often seen in BMI <30 group, as shown Table 5. There is a need for further studies on this issue.

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### References

1. Gürbüz HA, Durukan AB, Salman N, Uçar HI, Yorgancıoğlu. Obesity is still a risk factor in coronary artery bypass surgery. Anatol J Cardiol 2014; 14: 631-7. **[CrossRef]**
2. Allama A, Ibrahim I, Abdallah A, Ashraf S, Youhana A, Kumar P, et al. Effect of body mass index on early clinical outcomes after cardiac surgery. Asian Cardiovasc Thorac Ann 2014; 22: 667-73. **[CrossRef]**
3. Hernandez AV, Kaw R, Pasupuleti V, Bina P, Ioannidis JP, Bueno H, et al. Association between obesity and postoperative atrial fibrillation in patients undergoing cardiac operations: a systematic review and meta-analysis. Ann Thorac Surg 2013; 96: 1104-16. **[CrossRef]**

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## Author`s Reply

To the Editor,

We would like to thank the authors for their contribution to our study entitled "Obesity is still a risk factor in coronary artery bypass surgery" published in Anatol J Cardiol 2014; 14: 631-7. (1) and their valuable comments. They have mentioned that, as outlined in Table 3, some preoperative demographic characteristics in obese and non-obese groups differed. They have also stated that these factors could play a role in postoperative morbidity and mortality. However, we know that female gender, diabetes, and hypertension are comorbidities of obesity. It is not easy to say that these factors played a direct role on adverse effects. It would be more reliable to state that the comorbidities of obesity increase these adverse outcomes. However, multivariate analysis could have been performed to increase reliability. We have re-analyzed the effect of each mentioned parameter on adverse effects