Original Article

Effect of Professional Exercises on Brain Natriuretic Peptide

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Background: Brain natriuretic peptide (BNP) reflects myocardial wall stress. BNP activities are similar to those of atrial natriuretic peptide, including diuresis, natriuresis, hypotension and smooth muscle relaxation as well as ability to inhibit the rennin aldosterone system. It is mainly produced and released into the circulation by the ventricle in response to increased ventricular wall pressure or stretching. Therefore, BNP can be served as a marker of left ventricular dysfunction. The aim of this study was to investigate effect of various professional exercises on plasma BNP levels.
Methods: We enrolled 20 consecutive healthy professional athletic males from different sporting disciplines including 5 football players, 5 volleyball players, 5 bodybuilders and 5 water- polo players. Plasma BNP samples were taken immediately before and 1 hour after exercise.
Results: Plasma BNP level was significantly increased after exercise (30.01 ± 23.46 vs. 16.72 ± 10.86 pg/ml; P= 0.042). The highest increase in BNP level was found among volleyball players (mean values: 19.12 to 43.38 pg/ml; 126.3% increase after volleyball) compared to other exercises.
Conclusion: Exercise can increase plasma BNP levels, particularly among volleyball players.

Keywords: Brain Natriuretic Peptide, Exercise, Wall Stress

Introduction

Brain natriuretic peptide (BNP) belongs to cardiac-derived mediators.[1,2] By affecting both blood volume and pressure, it plays a key role in cardiovascular homeostasis.[1- 4] BNP is mainly secreted from the left ventricular myocytes. Its measurement is used as a biological hormonal marker in the diagnosis and prognosis of ischemic cardiac dysfunction and heart failure.[1,5,6-8] In practice, there is increasing recognition of the importance of BNP in the pathophysiology, diagnosis and treatment of certain cardiac disorders. In addition, BNP may facilitate the early diagnosis of heart failure by detecting asymptomatic left ventricular dysfunction or myocardial ischemia and may be used as an objective blood test for these indications.[9-14] In a study on athletes, participating in a 100-km ultra- marathon, the increase in BNP correlated to the increase in cardiac Troponin-T after the run and was interpreted as the result of exercise-induced sub-clinical myocardial cell damage.[4]

To our knowledge there is no published report regarding BNP level changes after professional exercises. The aim of this study was to evaluate BNP level changes after vigorous exercises among healthy professional athletes.

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Patients and Methods

A total of 40 blood samples from 20 healthy

professional athlete males aged from 20 to 30 years were collected for measurement of plasma BNP. All of the subjects were healthy, normotensive volunteers and free from cardiovascular disease. We enrolled 20 consecutive healthy men professional athletes from different sporting activities comprising 5 football, 5 volleyball and 5 water polo players, as well as 5 bodybuilders. Plasma BNP samples were taken immediately before and 1 hour after exercise. All patients gave written informed consent before participation. Specimens were collected into tubes containing EDTA. Plasma BNP concentrations were determined by a commercial kit.

Statistical Analysis

The results are presented as mean ± SD. P values less than 0.05 was considered statistically significant.

Results

The plasma values of BNP level of the studied subjects are shown in Table 1,where the plasma BNP level was significantly increased immediately after exercise as compared with baseline values (30.01±23.46 vs. 16.72±10.86 pg/ml; P=0.042). The highest increase in BNP level was found among volleyball players (mean values: 19.12 to 43.38 pg/ml; 126.3% increase after volleyball) compared to other exercises.

Table 1. Effect of various exercises on brain natriuretic peptide

	Baseline	one hour after exercise
Football	26.3 ± 12.9	48.5 ± 18.4
Volleyball	19.1 ± 11.8	43.4 ± 30. 6
Water Polo	9. 5 ± 2.1	12.4 ± 4.3
Bodybuilding	12.0 ± 5.9	15.7 ± 5.6

Data are presented as mean ± SD

Discussion

Possible mechanisms of BNP rise after vigorous exercise

1-Myocardial cell injury

In a study on athletes, participating in a 100-km ultra- marathon, the increase in BNP correlated to the elevation in cardiac Troponin-T after the run and was interpreted as the result of exercise-induced subclinical myocardial cell damage.[4] Beside myocardial cell necrosis, an alternative explanation for the exercise-induced release of troponin in healthy athletes seems to be the release of cytoplasmic free Troponin-T and I by leaking across the myocytes' membrane due to a transient increase in membrane permeability.[4] In our study, significant increases in plasma BNP immediately after exercise may reflect sub-clinical myocardial cell injury.

2-Hemoconcentration

Hemoconcentration is a common phenomenon encountered in subjects after acute exercise.[10-19] Circulating hormonal values after exercise may reflect acute trans-capillary passage of water, which resolves shortly after exercise ceases.[19,20] In previous studies, positive correlations between BNP, Aldosterone, ACTH, T3, and T4 values with hematocrite suggested that hemoconcentration affects the concentrations of circulating hormones.[21-23] In our study, significant increases in plasma BNP immediately after exercise may reflect the presence of hemoconcentration. However, a significant increase in BNP values immediately after exercise, even after correction for Hct, was also found in a previous study,[24] suggesting that factors other than

hemoconcentration might contribute to the secretion of BNP immediately after exercise.

3-Angiotensin-converting enzyme Gene Polymorphism

The effect of exercise on changes in plasma BNP concentration has been related to angiotensin-converting enzyme (ACE) gene polymorphism.[11,18] Increased BNP levels with training were found to be dependent on ACE genotype. Exercise-induced BNP increase also occurred in individuals with cardiovascular disorders.[15,19] These results suggest that factors, such as volume overload, wall stretch, and hemodynamics as well as neurohormones may contribute to exercise-induced increases in BNP.[24-26] On the other hand, it was also found that increased BNP might serve as a protective and compensatory mechanism against further deterioration. Systolic blood pressure and plasma epinephrine values were found to be related to BNP release suggesting that sympathetic stimulus may also play a role.[27]

4-Volume-Related Stimulus

Plasma BNP values could also be related to volume-related stimuli, such as a high-sodium diet, passive leg raising or the sitting position.[27]

In summary, prolonged strenuous exercise induces independent increases in BNP and Troponin, and consequently, different causes of release have to be assumed. Even when clinical values are exceeded, the release of BNP during and after exercise may reflect myocardial damage but may have cyto-protective effects. In conclusion, measurement of circulating BNP values is a clinically available method for evaluating patients with suspected cardiovascular dysfunction. A significant increase in plasma BNP was found in healthy subjects immediately after exercise. Thus, we suggest that for clinical measurement of BNP, plasma samples should not be taken immediately after exercise to avoid possible physiologic variations.

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