Relationship Between Total Homocysteine Levels and Folate Concentrations in the Serum of Patients with Myocardial Infarction

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Abstract

Objectives: To determine relationship between the level of serum total homocysteine and folate in patients with myocardial infarction.

Design and methods: The serum total homocysteine level was measured using gas chromatography. Serum folate was determined by competitive immunoassay using direct chemiluminescence on the ACS 180 Analyzer.

Results and conclusions: serum total homocysteine levels were significantly and negatively correlated with folate in patients with myocardial infarction.

Key words: Folate, homocysteine, myocardial infarction

Introduction

Plasma homocysteine is a clinically useful indicator of vitamin function. Most patients with folate or cobalamin deficiency have moderate to intermediate hyperhomocysteinemia, which is corrected after supplementing the deficient vitamin. Folate is a cofactor for methionine synthetase, an enzyme that recycles homocysteine into methionine. If folate levels are insufficient, homocysteine levels rise. Elevated homocysteine levels have been associated with the risks of coronary, cerebral, and peripheral vascular disease. Increased plasma homocysteine appears to be a significant independent risk factor for premature cardiovascular disease suggesting a large future demand for plasma homocysteine. An inverse relation between both red-cell folate levels and serum vitamin B12 concentrations and hyperhomocysteinemia has been reported by several authors. Folic acid administered alone with pyridoxine, even to subjects without folate deficiency, can reduce serum homocysteine concentration. The concentration of homocysteine in plasma or serum is an established marker of common disease. It is a strong and independent risk factor for cardiovascular disease, a sensitive marker of cobalamin and folate deficiencies.

Low serum folate levels are often associated with high homocysteine levels and can be reduced by administration of folic acid. The determination of serum total homocysteine and folate for the diagnosis of myocardial infarction patients will be an important finding of the clinical chemistry laboratory feature. Our goal in the present study was to investigate the relationship between the serum total homocysteine and serum folate level.

Materials and methods

Reagent and chemicals

Cation-exchange resin, AG 50W-X8 and the anion-exchange resin AG1-X8 were obtained from (Bio-Rad Laboratories, Richmond, CA). Homocysteine were purchased from Sigma Chemical Co. (St. Louis, Mo., USA). All chemicals used were guaranteed-grade reagents and were used without further purification. All solutions were prepared with distilled de-ionized water.

Equipment

Drying was performed on a vacuum concentrator (Savant Instruments, Inc., Hicksville, NY). Sample analysis was performed on a MPC gas chromatography with dual flame ionization detectors and with a Epson printer. Sample resolution was achieved on a fused silica capillary column (30m 0.25mm i.d., 0.25-μm film thickness)

Serum

Blood samples were obtained from blood donors at the Shahid Beheshti Hospital. The study group consisted of 126 patients 67 male, and 59 females, aged 39-81 (mean 47.11±5.7) years. The control group consisted of 135 normal volunteers, 71 male and 64 females, age 41-63 (mean 52.73±6.77) years. The population studied include 135 (controls) with no history of cardiovascular disease, and 126 patients (cases), the diagnosis, based on criteria established by the World Health Organization, included typical or atypical chest pain, unequivocal changes in the electrocardiogram. Single myocardial infarction was

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Result

Under the chromatographic condition used, the total homocysteine derivative is well separated with a retention time of 3.32 minutes. For comparison the retention time of the homocysteine standard was 3.32. A typical chromatogram obtained with total homocysteine is shown in figure 1 and demonstrates that the capillary column gives a complete separation for this amino acid. The mean serum folate concentration in the normal subjects and the patients reported in figure 2.

The mean serum folate level was 14.67±1.33 nmol/L, for males and 17.59±1.38 nmol/L for females controls. The mean of folate was 5.23±1.24 nmol/L for males cases and 6.19±1.88 nmol/L for females cases. Cases were found to have lower serum folate levels than controls (p<0.05).

The mean total homocysteine concentration in the normal subjects and the patients reported in figure 3. The mean serum total homocysteine level was 10.55±1.48 pmol/L for males and 12.75±1.26 pmol/L for females controls. The mean of total homocysteine was 23.72±2.86 pmol/L for males cases and 25.05±2.44 pmol/L for females cases. Cases were found to have higher serum total homocysteine levels than controls (p<0.05). The mean serum total homocysteine level was plotted by mean folate level (figure 4). Serum homocysteine levels were significantly and negatively correlated with folate in patients with myocardial infarction.

Discussion

In the past decade, renewed interest in homocysteine has been emerged by the association between moderate hyperhomocysteinemia and vascular disease. It remains to be determined whether lowering homocysteine levels in subjects with elevated homocysteine levels will prevent the formation of atherosclerosis. Although the rationale for moderate to high dose folic acid or vitamin B<sub>6</sub> is based on sound biochemical principles, no clinical proof of efficacy exists in the treatment of moderate hyperhomocysteinemia and the reduction in atherothrombotic events. An overwhelming amount of evidence supports the hypothesis that mild hyperhomocysteinemia is an important and independent risk factor of occlusive vascular disease.
MicroPars Co. GC-101, A Recorder & Chromatopac Report

Method of peak calculation = height normalization

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Fig. 1: Chromatogram of derivatized serum total homocysteine. Injected sample size was 10 µl. The retention time for homocysteine was 3.32 minutes.

![Graph](image)

**Fig. 2**: Serum folate levels in control and myocardial infarction. Each column represents the mean value ± SD of 6 separate experiments. (Each panel: column 1, male, column 2, female).

![Graph](image)

**Fig. 3**: Serum total homocysteine levels in control and myocardial infarction. Each column represents the mean value ± SD of 6 separate experiments. (Each panel: column 1, male, column 2, female).
In the present study, we investigated the relationship between serum total homocysteine and serum folate. Our study was performed in a population of patients with myocardial infarction and in controls. In patients, group serum total homocysteine levels were elevated above the normal range. The average maximal value of all patients was at least two times greater than the normal subjects, which partly explains the high diagnostic sensitivity of present assay for myocardial infarction. Our results were in agreement with those reported previously. In patients group serum folate levels were decreased from the normal range. Our results were in good agreement with those reported previously. As seen in this work, an inverse relation was observed with folate and serum total homocysteine level. The results presented in this paper indicate that elevated total homocysteine level is related to low serum folate concentration. Results obtained from this paper is like those of other authors. It is too early to predict whether serum homocysteine, like cholesterol, will be used in the routine screening of healthy individuals. However, for individuals with family histories of unexplained premature vascular disease, measurement of fasting and post-methionine loading homocysteine should definitely be considered. The determination of serum total homocysteine and folate for the diagnosis of patients with myocardial infarction will be an important feature of the clinical chemistry laboratory.

References


