ORIGINAL ARTICLE

A practical method to diagnose muscle degradation in normonourished patients with chronic heart failure

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ABSTRACT

Background & Aim of the study

The goal of this study was to investigate muscle protein degradation (MPD) and find possible biohumoral indicator of MPD in patients with chronic heart failure (CHF). Plasma 3-methylhistidine concentration (3MEH) could be high in clinically stable CHF with normal renal function and blood urea levels (BU) could be a proxy of 3MEH in clinical environments.

Methods

In 38 outpatients with stable CHF (30 males and 8 females; 56.4±10.6 yrs) and 17 healthy subjects (13 males and 4 females) we determined 3MEH, BU and creatinine (CR) concentrations in peripheral venous blood. The tests were made at 8 am, after a meat-free diet on the previous day.

Results

Compared to controls, patients had higher concentrations of plasma 3MEH (9.5±4.8 vs 3.7±1.1 μmol/L; p<0.001) blood BU (45.65±2 vs 29.88±2.38 mg/dl; p<0.001) serum CR (1.043±0.02 vs 0.892±0.03; p=0.002). Moreover, 3MEH was positively correlated with BU (r=+0.49; p<0.001), resting VO_2/Kg (n=24, r=+0.48; p=0.02), NYHA functional class (r=+0.32; p<0.05) in the studied patients. It was found that with a BU threshold of 38mg/dl, BU can predict 3MEH levels higher than 6μmol/L with 68% probability.

Conclusions

The study showed a high prevalence of MPD in stable CHF. BU can positively predict MPD in 70% of patients.

Keywords: *heart failure, blood urea, muscle protein degradation, muscle proteins, creatinine, nutritional status*

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INTRODUCTION

Patients with heart failure often are characterized by muscle wasting and weakness responsible for exercise intolerance and reduced survival.[1,2] One important mechanism that leads to wasting of both muscle mass and function is represented by increased myofibrillar protein degradation (MPD).

The ability of estimating MPD under clinical conditions could be highly desirable. For research purposes, MPD can be assessed by using isotope methods[3] which are impractical in clinical settings. For clinical practices, an estimate of MPD can be made by measuring the amino acid 3-methylhistidine (MEH) levels in plasma or in 24-hour urine output.[4,5] This amino acid is formed by methylation of the histidine t-RNA complex, which occurs only in actin and myosin. After proteolysis, it can not be re-used[6], so is eliminated and quantitatively cleared by the kidney.[7] Therefore, in absence of renal failure, increased 3MEH is an index of myofibrillar (contractile) protein breakdown.[8,9]

Both early and recent investigations have indicated that 3MEH could be a sensitive indicator of MPD in fasting healthy subjects[5], in malnourished children on nutritional support[10], in patients on total parenteral nutrition[9], in intensive care individuals undergoing muscle electrical stimulation[11] and finally in acutely burnt children treated with early enteral support.[12]

To our knowledge, so far no studies have measured 3MEH in patients with CHF. We suspected that there was a high prevalence of MPD in patients with increased plasma levels of 3MEH, given the profound plasma hormonal, and/or metabolic, and/or inflammatory alterations characterising CHF.[13-17] Therefore, the first aim of this study was to document the prevalence of high 3MEH in outpatients with CHF and normal renal function.

As the determination of 3MEH could be both expensive