

Gastro-intestinal Protein Loss in Elderly Patients with Cardiac Cachexia

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Summary

Undernutrition resulting from chronic congestive heart failure (cardiac cachexia, CC) increases morbidity and mortality particularly in elderly people. The aetiology of CC is thought to be multifactorial. We have assessed the presence of gastro-intestinal protein loss in a group of patients with CC and a group of healthy age- and sex-matched controls.

Gastro-intestinal protein loss was measured using the ^{51}Cr chromic chloride test in 29 patients with CC [mean age 76.1(SD 4.4) years] and 29 healthy controls [mean age 74.9(SD 4.8) years]. The patients were undernourished in terms of anthropometric measurements compared to controls. The patients had a significantly lower mean ejection fraction [41.5(18.3)% vs. 65.5(2.2)%] and higher mean pulmonary artery pressure [89.4(19.9) mmHg vs. 19.3(8.1) mmHg]. The recovery of radioactivity in a 5-day stool collection was similar in the two groups [patients vs. controls: 1.0(0.7)% vs. 0.98(0.6)%, $p = 0.9$]. These values are within the expected normal range.

We conclude that gastro-intestinal protein loss is not a significant factor in the production of cardiac cachexia.

Introduction

Malnutrition due to chronic heart failure has been termed cardiac cachexia. It may be present in up to 50% of patients with heart failure [1] and is associated with increased morbidity and mortality. It is likely to be particularly common in elderly people [2] because of the high incidence of both heart failure and undernutrition from other causes in this age group. The aetiology of cardiac cachexia is probably multifactorial [3]. It has been claimed that a protein-losing enteropathy is an important cause [4, 5]. We have therefore quantified gastro-intestinal protein loss in a group of elderly patients with cardiac cachexia and compared the results with a group of healthy controls.

Methods

Twenty-nine patients (20 women) with cardiac cachexia [mean age = 76.1(4.1) years] and 29 (20 women) healthy controls [mean age = 74.9(4.8) years] were studied. The study was approved by the District Ethics Committee and the Administration of Radioactive Substances Advisory Committee (ARSAC). All subjects gave informed consent.

All patients had clinical evidence of left ventricular failure and a chest radiograph showing pulmonary oedema at the time of initial diagnosis. Congestive heart failure had been present for at least 3 months and patients had been on optimal medical treatment. Patients were selected on the basis of a minimum weight loss of 6 kg within the preceding 12 months. Healthy controls were recruited from local GP registers and luncheon clubs. Subjects were excluded if they had other diseases causing

undernutrition (diabetes, thyrotoxicosis, cancer, gastro-intestinal disease or previous gastro-intestinal surgery).

All subjects underwent a clinical history, examination, chest radiography and electrocardiography (ECG). Fasting blood samples were drawn for albumin (Alb) and total protein (TP). Samples were analysed in one hospital laboratory (Excel Analyser, Indianapolis, USA). For control subjects the results of a full blood count, liver function tests and electrolytes were within normal reference ranges.

Anthropometric measurements were performed by a single experienced observer (D.K.). Height (m) and weight (kg) were recorded and body mass index (BMI) was calculated as $\text{weight}/\text{height}^2$ (kg/m^2). Triceps skin-fold thickness (TS) (mm) was measured using Harpenden calipers. Mid-arm circumference (MAC) (cm) was measured using a plastic tape at the midpoint between the acromion and olecranon process. The mean of three measurements for TS and MAC was recorded. Arm muscle circumference (AMC) (cm) was derived from the formula:

$$\text{AMC} = \text{MAC} - (\text{TS} \times 0.3142)$$

Two-dimensional echocardiography (Hewlett Packard, Sonos 500 machine) was used to calculate ejection fraction (EF) and pulmonary artery pressure (PAP) was measured by continuous-wave Doppler.

Gastro-intestinal protein loss was measured using the ^{51}Cr chromic chloride test ($^{51}\text{CrCl}_3$) [6]. $^{51}\text{CrCl}_3$ labels transferrin *in vivo* and its recovery in faeces after intravenous administration is a measure of gastro-intestinal protein loss. All subjects received 2MBq $^{51}\text{CrCl}_3$ intravenously. Stool collection began 12 hours after the injection and continued for 5 days. $^{51}\text{CrCl}_3$ is excreted by the kidney and therefore

Table. Nutritional and cardiac measurements in patients and controls

	Controls (n = 29)	Patients (n = 29)	p
<i>Nutritional measurements</i>			
Weight (kg)	67.5(14.8)	39.4(19.9)	< 0.001
Height (m)	1.63(0.1)	1.62(0.1)	NS
Body mass index (kg/m ²)	25.3(3.9)	19.6(2.5)	< 0.001
Triceps skin-fold (mm)	23.7(9.6)	10.5(3.4)	< 0.001
Mid-arm circumference (cm)	29.2(3.3)	23.0(2.0)	< 0.001
Arm muscle circumference (cm)	21.7(3.2)	19.7(2.2)	< 0.01
Plasma albumin (g/l)	42.9(2.5)	41.0(4.1)	< 0.05
Plasma total protein (g/l)	71.7(2.6)	72.0(5.5)	NS
<i>Cardiac measurements</i>			
Ejection fraction (%)	65.5(11.8)	41.5(18.3)	< 0.001
Pulmonary artery pressure (mmHg)	19.3(8.1)	39.4(19.9)	< 0.001

detailed instructions were given to avoid contamination by urine. The percentage of administered activity excreted in the stools was measured by standard bulk assay counting. All tests were performed on an outpatient basis. Results are reported as mean (SD), and differences between patients and controls were analysed using Student's *t* test. All variables followed a normal distribution.

Results

The mean duration of congestive heart failure was 83.4(102.2) months. The mean weight loss of the patients in the preceding 12 months was 8.5(3.2) kg, and there had been no weight loss in the control group. The aetiology of congestive heart failure was rheumatic valvular heart disease (12), idiopathic dilated cardiomyopathy (5), ischaemic heart disease (4), unknown (3), atrial septal defects (2), patent ductus arteriosus (1) and hypertension (2). The severity of heart failure (New York Heart Association classification) was: II(9), III(15). Thirteen patients were taking more than 120 mg of frusemide daily, four were also taking a thiazide diuretic and 18 had been prescribed an angiotensin-converting enzyme inhibitor.

The patients were clinically undernourished compared with the controls (Table). Although patients had a lower serum albumin they could not be considered hypoproteinaemic as the reduction was minimal. The ejection fraction was lower in the patients. The mean pulmonary artery pressure was technically measurable in 26 patients and 23 controls and was higher in the patients. The mean PAP in the patients was higher than the expected normal range (< 18 mmHg).

The 5-day stool collection was completed by all subjects but was contaminated by one control subject and therefore discarded. There was no difference in the percentage of administered activity recovered from the stools of patients and controls [1.00(0.7)% vs. 0.98(0.6)%, *p* = 0.90] (Figure). These results are within the normal range.

Discussion

Gastro-intestinal protein loss in patients with heart failure has mainly been found in association with constrictive pericarditis [4, 5]. Davidson *et al.* [4] described three patients with constrictive pericarditis

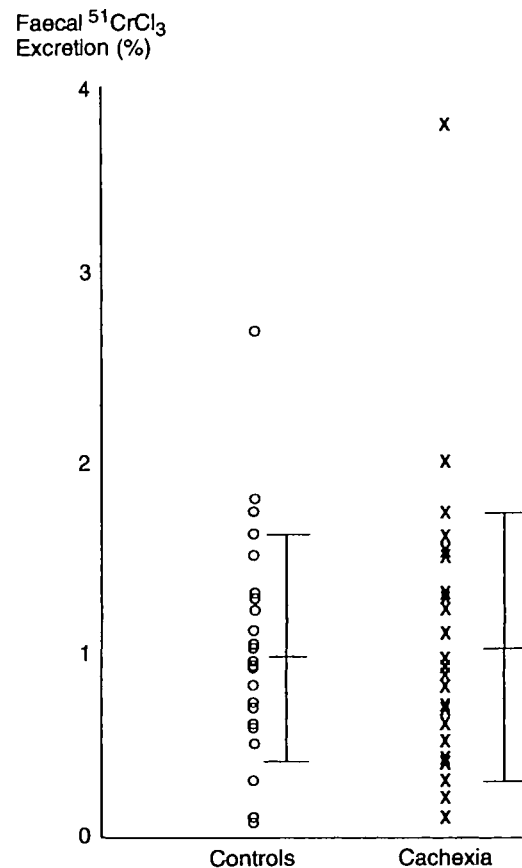


Figure. Five-day faecal excretion of ⁵¹CrCl₃ in cachectic patients and controls [mean (SD)].

and one with an atrial septal defect who were all hypoproteinaemic and showed evidence of significant gastro-intestinal protein loss. The hypoproteinaemia resolved after correction of the cardiac defects. Other workers have demonstrated protein-losing enteropathy associated with primary myocardial disease [7] and tricuspid regurgitation [8]. Although these cardiac diagnoses are diverse they are all characterized haemodynamically by raised right heart pressures with elevation of right atrial and central venous pressures. The histology of the gut in these patients ranged from 'mild hyperaemia and slight dilatation of the capillary and lymphatic vessels' [6] to 'dilatation of the lacteals of the villi' [5]. The latter group are similar to patients with intestinal lymphangiectasia, a congenital disease of the lymphatics characterized by a protein-losing enteropathy ('idiopathic hypoproteinaemia').

It has been postulated that the elevated venous pressure results in oedema of the bowel wall and exudation of protein. All the cases previously described were associated with a raised right heart pressure and had evidence of uncontrolled heart failure with marked peripheral oedema. We have shown that patients with controlled heart failure and evidence of undernutrition have no gastro-intestinal protein loss even in the presence of significantly increased right-sided heart pressures.

Gastro-intestinal protein loss is likely to be rare in patients with cardiac cachexia and is therefore not a significant factor in its production. Further research to elucidate the significance of other mechanisms is required.

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