Chronic intermittent haemofiltration and haemodialysis in end stage chronic heart failure with oedema refractory to high dose frusemide

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Abstract

Objective—To assess the benefits and problems of chronic intermittent treatment with haemofiltration or haemodialysis or both in patients with severe chronic heart failure (New York Heart Association class III or IV) and oedema refractory to pharmacological treatment. **Design and setting**—A retrospective case-cohort study. A general hospital in The Netherlands.

Patients—The results of chronic intermittent treatment with haemofiltration (n = 10) or haemodialysis (n = 2) were analysed in patients with severe chronic heart failure, predominantly due to coronary heart disease, and oedema refractory to a pharmacological regimen including high dose frusemide. **Intervention**—Patients had an average of 25 (SD 38) treatments.

Results—There was improvement of NYHA class IV to III in seven patients. However, this was not reflected in a decrease in hospital admission: only two patients could be managed as outpatients. The median survival after start of the treatment was 24 days (varying from 0 to 393 days). In four patients the treatment was discontinued after discussion with the patient and family.

Conclusions—The use of chronic intermittent haemofiltration and haemodialysis is of limited value in end stage chronic heart failure with oedema, refractory to maximal conventional treatment.

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Keywords: haemofiltration; end stage heart failure; high dose frusemide.

Chronic heart failure is a major health problem.¹ Ultimately many patients become unresponsive to maximal conventional treatment and remain severely symptomatic. Short term relief of symptoms may be obtained by removing fluid, either by venesection, haemodialysis, haemofiltration, or peritoneal dialysis.²⁻⁷ The use of these techniques in the acute setting may be worthwhile and can result in the restoration of diuretic responsiveness.

Chronic intermittent haemofiltration and continuous ambulatory peritoneal dialysis of patients with heart failure may improve survival.⁸⁻¹¹ The wide range in outcome in these studies reflects the differing definitions of maximal pharmacological treatment and the heterogeneity of the patients studied. Often data are lacking about the maximum doses of diuretics, the use of inotropic or preload reducing drugs, and the severity of left ventricular dysfunction at the start of chronic intermittent treatment. We therefore set out to determine whether haemofiltration and haemodialysis used in this way can improve the quality of life in patients with chronic heart failure unresponsive to maximum conventional treatment, including high doses of frusemide (500 to 4000 mg daily dosage).

Methods

PATIENT CHARACTERISTICS

In this retrospective study we reviewed data of 12 patients who were treated in our hospital between October 1979 and April 1991. The clinical characteristics of the studied patients are shown in table 1. The mean age of the patients was 68 years, the predominant cause of chronic heart failure was coronary heart disease, and all but one were in New York Heart Association (NYHA) class IV. Other complicating conditions were also commonly present: other vascular disease (n = 7), diabetes mellitus (n = 4), chronic obstructive pulmonary disease (n = 1), and renal disease (n = 4). All patients were severely symptomatic with marked peripheral oedema. Left ventricular ejection fraction values, by cross sectional echocardiography, were 21-30% (n = 2 patients), 11-20% (n = 3), and less than 10% (n = 4). The resting supine systolic blood pressure ranged from 130 to 60 mm Hg (median: 90 mm Hg).

PREVIOUS TREATMENT

Treatment consisted of salt restriction, bed rest, and drug treatment including diuretics, ACE inhibitors, digoxin, and dopamine

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Table 1 Characteristics of the patients before the start of the haemofiltration treatments

Patient	Sex	Age (years)	NYHA	Underlying disease	Frusemide dosage (mg)	Other medication
1	M	64	IV	CHD	500 Po	Dig, Vd
2	F	75	IV	CHD	1000 Po	Dig
3	M	62	IV	CM	1500 Po	Dig, Ace
4	M	77	IV	CHD	1000 Po	Dig, Ace, Vd, Do
5	M	71	IV	CHD	2000 IV	Dig, Ace
6	M	76	IV	CHD	1500 Po	Dig, Ace, Vd
7	M	61	III	CHD	2000 IV	Dig, Ace
8	F	71	IV	VAD	2000 Po	Dig, Ace, Do
9	M	56	IV	CHD	1000 Po	Ace
10	M	72	IV	CHD	2000 Po	Ace, Do
11	M	66	IV	CHD	4000 IV	Ace, Do
12	M	64	IV	CHD	3000 IV	Dig, Ace, Do

Ace, angiotensin converting enzyme inhibitors; CHD, coronary heart disease; CM, cardiomyopathy; Dig, digitalis; Do, dopamine; F, female; IV, intravenously; M, male; Po, orally; VAD, valvar disease; Vd, vasodilator.

(table 1). All patients showed diuretic resistance, defined as a failure to lose weight or to develop a negative sodium balance despite bed rest, a sodium intake restriction of 80 mmol/d, and high dose frusemide [1790 (SD 960) mg]. Frusemide was given orally in eight patients and by continuous intravenous infusion in four. Doses of frusemide exceeding 250 mg/d were given for at least 22 days [mean 236 (209) days] before the start of haemofiltration or haemodialysis.

LABORATORY DATA AT THE START
Before haemofiltration, renal function was considerably decreased in all patients. Endogenous creatinine clearance (ECC) ranged from 8 to 26 ml/min/1.73 m², with a mean ECC of 15.7 (6.4) ml/min/1.73 m². The mean urea concentration was 40.4 (13.6) mmol/l (ranging from 20.3 to 68.0 mmol/l). The serum sodium concentration varied from 118 to 146 mmol/l, mean 132 (7.1) mmol/l. Serum potassium before treatment varied from 3.2 to 6.1 mmol/l, mean 4.5 (1.0) mmol/l. The mean haemoglobin concentration was 7.8 (1.1) mmol/l (range 6.0 to 9.9 mmol/l).

Results
HAEMODIALYSIS AND HAEMOFILTRATION
The initial treatment consisted of haemofiltration (n = 10) or haemodialysis (n = 2). During the first session a double lumen femoral vein catheter was used as a vascular access in seven patients, a subclavian double lumen catheter in one, a Scribner shunt in one, and a Cimino-Brescia fistula in three.
The mean number of haemodialysis or haemofiltration treatments per patient was 25 (38) (ranging from one to 113). The mean treatment interval was 5.7 (9.1) days (table 2). The maximum treatment interval was 33 days. The mean weight reduction during the first treatment procedure was 4.0 (1.7) kg (ranging from 1.2 to 6.2 kg). The total weight reduction (weight before first treatment minus weight before last treatment) was 8.4 (8.5) kg (table 2).

COMPLICATIONS, QUALITY OF LIFE, SURVIVAL
Four patients reported no complaints during the treatment, one reported nausea and loss of hearing as main complaints, while three suf-

fered from angina pectoris unresponsive to pharmacological treatment. Four patients became confused or had a decreased level of consciousness. Seven improved from NYHA class IV to class III, while five showed no change. In four patients the treatment was discontinued after discussion with the patient or his family. Other causes of death were hypotension (three patients), respiratory insufficiency (two patients), and sudden death probably caused by a fatal arrhythmia (three patients).
Patients were admitted to hospital for 12 (9)% of the time during treatment with high dose frusemide. During treatment with haemofiltration or haemodialysis, patients were in hospital for 80 (35.4)% of the time. Eight patients were in hospital continuously, two were managed as outpatients for the major part of their treatment, while two others could be discharged for a short period [14 (of 24) and 23 (of 393) days, respectively].
The median survival after the start of haemofiltration treatment was 24 days, varying from 0 to 393 days. The median survival after the last treatment was three days, varying from 0 to 23 days.

Discussion
High dose frusemide is an effective, safe, and controllable means of treating patients with severe chronic heart failure refractory to the conventional dosages of frusemide,¹² but resistance even to high dose frusemide may develop. Our study shows that the use of haemofiltration and haemodialysis in patients with end stage chronic heart failure who have become unresponsive to such pharmacological treatment is of little benefit for either length or quality of life.
Peritoneal dialysis and haemofiltration may be of value in the treatment of patients with acute heart failure unresponsive to high dosages of diuretics and inotropic drugs.²⁻⁷ However, the place of these non-pharmacological approaches used on a chronic intermittent basis in the treatment of refractory chronic heart failure remains unclear, although the idea that excess of body water can be removed on a regular basis by the use of peritoneal dialysis or haemofiltration, analogous to the treatment of end stage renal failure, seems appealing.
In contrast to haemodialysis, adverse haemodynamic effects are limited in peritoneal dialysis and haemofiltration, which makes these two techniques more suitable for the treatment of refractory chronic heart failure.¹³ Despite its negative haemodynamic side effects, two patients in this study had to be treated with haemodialysis because of life threatening uraemia. Renal function was seriously impaired initially in all patients, at least in part because of heart failure, and declined further during treatment with haemofiltration in the majority.
In some of the studies describing the use of haemofiltration or peritoneal dialysis in chronic heart failure, an improvement in both haemodynamics and responsiveness to diuretics after

Table 2 Clinical data concerning the haemofiltration treatment

Patient	Method	Mean treatment interval (days)	Total weight reduction (kg)	NYHA class during treatment	Period of treatment (days)	Cause of death
1	HD	2.3	6.8	III	223	DT
2	HF	1.9	15.1	III	21	RI
3	HF	33.0	-7.4	III	165	CS
4	HF	3.0	9.7	IV	9	DT
5	HF	12.0	6.9	IV	24	DT
6	HF	3.0	18.7	III	24	DT
7	HD	3.5	1.5	II	393	FA
8	HF	2.2	1.6	III	20	CS
9	HF	1.7	7.9	III	22	FA
10	HF	0.0	1.2	IV	0	CS
11	HF	2.2	21.1	III	76	RI
12	HF	3.0	17.2	IV	24	FA

CS, cardiogenic shock; FA, fatal arrhythmia; HD, haemodialysis; HF, haemofiltration; RI, respiratory insufficiency; DT, discontinuation of treatment.

the first session was observed, making further treatment of this kind unnecessary.^{2 4-7 10} This cannot be completely explained by the influence of massive oedema on the pharmacokinetics and pharmacodynamics of high dose frusemide.¹⁴ In our study only one patient could be treated at intervals of greater than 10 days over a long period.

Life was substantially prolonged in only four patients and the median survival after the start of haemofiltration was short. Moreover, most patients were in hospital throughout the period of haemodialysis. Any improvement in NYHA class was limited. The slight benefit, combined with the high cost, make it questionable whether patients with end stage chronic heart failure refractory to high dose frusemide should be offered chronic haemofiltration.

The addition of a thiazide diuretic, acting on the distal tubule, is effective, even in patients with markedly impaired renal function.¹⁵ Treatment with a combination of diuretics acting on different segments of the nephron may be an alternative to chronic intermittent haemofiltration. In our view treatment with haemofiltration or haemodialysis in patients with chronic heart failure should only be considered when a remediable cause of heart failure is suspected or as a bridge to heart transplantation.^{10 12}

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