Original Article

PALLIATIVE MEDICINE

Palliative Medicine
25(6) 658–663

DOI: 10.1177/0269216311399490
pmj.sagepub.com
SAGE

Is there a role for subcutaneous furosemide in the community and hospice management of end-stage heart failure?

Hannah Zacharias *Yorkshire and Humber Deanery, UK*
Janet Raw *North Yorkshire and York Primary Care Trust, UK*
Anne Nunn *St Catherine's Hospice, UK*
Sharon Parsons *North Yorkshire and York Primary Care Trust, UK*
Miriam Johnson *Hull York Medical School, University of Hull; St Catherine's Hospice, UK*

Abstract

Patients with advanced chronic heart failure (CHF) can experience 'revolving door' admissions, often for parenteral diuretics, when time at home is precious. Home intravenous diuretic services are patchy. This retrospective review describes 43 consecutive episodes of continuous subcutaneous infusion of furosemide (CSCI-F) in 32 advanced CHF patients; 28 episodes aiming to correct fluid balance and prevent hospital admission and 15 aiming to prevent symptoms in the dying.

Overall, 26/28 (93%) avoided hospital admission. Weight loss occurred in 20/28 (70%): a median loss of 5.6 kg [interquartile range (IQR) 0.1–8.9]). The daily dose of furosemide ranged from 40 to 250 mg. The median number of days on CSCI-F was 10.5 (range 2–48; IQR 6–13.8). Site reactions occurred in 10/43 (23%); all of which were mild except two, one of which required oral antibiotics. Symptoms were controlled in all 15 dying patients.

CSCI-F for patients with advanced CHF is effective in terms of weight loss and prevention of hospital admission with the heart failure nurse specialist playing a key overall management role in selection and monitoring. As the majority of community and hospice nurses have access to and are familiar with CSCI pumps, this practice should be nationally transferable. The role in the dying patient requires further assessment.

Keywords

Cardiac, furosemide, heart failure, infusions, oedema, palliative care, subcutaneous

Introduction

Chronic heart failure (CHF) is a common condition in the UK, affecting approximately 900,000 people. CHF costs the National Health Service £378.6 million per year with 60% of the allotted budget accounted for by hospital admissions (84,151 admissions; 2000–2001).[1]

Despite significant advances in the understanding of pathophysiology and subsequently in management, it still carries a poor prognosis and patients who do not die of co-morbid disease or sudden cardiac death live to develop progressive end-stage CHF with its recognized symptom burden for both patient and carer.[2–6]

Patients with advanced CHF are less able to compensate for their poor myocardial function and develop signs and symptoms of fluid overload with weight gain, peripheral, intra-abdominal and pulmonary oedema. Initially, this may be triggered by an event such as a chest infection, and may respond well to therapy, including parenteral diuretics. However, as the CHF gets worse, fluid balance may become so precarious, complicated by worsening renal function and increasing diuretic resistance, that the patient has repeated, so-called 'revolving

Corresponding author:
Miriam Johnson, St Catherine's Hospice, Throxenby Lane, Scarborough, North Yorkshire YO12 5RE, UK
Email: miriam.johnson@hyms.ac.uk

door' hospital admissions, mainly for parenteral diuretics at a stage when time at home can be precious. Hospital admission at this time may also de-stabilize community support and it can then be difficult to discharge the patient home and they die in hospital by default.

Providing care at home for patients at the end of life is a Department of Health priority.[7] Using the International Classification of Diseases codes to estimate place of death by cause of death from Office for National Statistics (ONS) statistics from 2002, approximately 18% of patients with CHF died in their own homes, 83% died in an acute or elderly care hospital bed and only 1% in a hospice.[8] In keeping with this, follow up of participants in the Acute Infarction Ramipril Efficacy (AIRE) study with regard to place and mode of death found that 95% of patients who died with progressive CHF did so in hospital.[9] Published literature indicates that many people wish to die at home provided they feel their carers are supported and their symptoms controlled and most wish to spend as long as possible cared for in their own homes, even if it is not possible for them to die there.[10]

It has been suggested that as it is uncertain which deterioration is the terminal one in CHF, active treatment often continues until the end, making advance planning and a change of emphasis to palliative care difficult.[11] However, where integrated palliative-cardiology services are gaining experience, this is not proving to be the case, and indicators of poor prognosis can be used as a guide to trigger exploratory conversations with patients and carers regarding their wishes 'should things get worse'.[12]

Continuous subcutaneous infusion (CSCI) of medication via a battery operated syringe driver has been used for over 30 years, revolutionizing the care of dying people, particularly in the community, allowing continuous levels of symptom control to be achieved. The administration of furosemide by this route is novel, but may be an effective alternative to the intravenous (IV) route.[13] Normal volunteers randomized to receive bolus subcutaneous injections of normal saline or furosemide showed an increased diuresis and natriuresis with furosemide compared with saline.[14] A case series of decompensated patients with HF demonstrated diuresis and natriuresis following subcutaneous administration of furosemide.[13] Administration using a syringe driver would also allow a continuous infusion. In the community, evidence suggests continuous infusion of IV infusion is superior to intermittent IV injection, especially where there is developing diuretic resistance;[15,16] a Cochrane review in 2005 showed that urine output was greater for those receiving continuous infusion, and toxicity was less.[17] A recently published study also showed improved urine output and shorter hospital stay in those with continuous infusion compared with intermittent, although a second study did not show any differences between the two groups.[18,19] In addition, there is some evidence that community administration of parenteral diuretic prevents hospital admission.[20]

For selected patients with advanced CHF, CSCI furosemide would potentially allow patients with advanced CHF who require parenteral diuretics, the choice to stay either at home or in the hospice. It would also provide an alternative route of administration in those who have lost, or dislike, the IV route. We therefore present the results of the first consecutive 43 episodes of using CSCI furosemide in patients with advanced CHF known to our integrated palliative-cardiology service.

Methods

The case notes of consecutive patients with CHF, who had received CSCI furosemide during the period between October 2006 and July 2009, were retrospectively reviewed.

The patients were known to the palliative-cardiology service multi-disciplinary team (MDT). Patients in the community were managed in collaboration with their general practitioner, and had access to an out-of-hours palliative care support phone line supported by nurses familiar with CSCI furosemide (PalCall, St. Catherine's Hospice).[21]

Data was entered prospectively on a data extraction form by the HF nurse specialist (HFNS) and hospice doctor involved in the patient's care at the time. The data was then checked retrospectively against the original documentation by a research nurse before being entered onto a spreadsheet.

The following was noted: weight, symptom control, particularly breathlessness and peripheral oedema (categorized empirically by the data inputter on the prospective form as mild/moderate /severe, and improvement counted if there was comment in the notes to support improvement), site reactions and place of care. Height of jugular venous pressure and audible crepitations on chest auscultation were noted where available. The daily dose of CSCI furosemide was calculated empirically in the absence of any published data, assuming that using the same daily dose as previously used by mouth would give, in effect, an increased dose bearing in mind the relatively poor oral absorption of furosemide. Where patients were taking oral bumetanide, an

approximation of 1 mg bumetanide to 40 mg furosemide was used.

The cases were categorized into four sub-groups, depending on the aim of treatment as follows.

Group A. Setting: community. Aim: stabilizing the condition (weight loss and improvement in clinical signs of fluid overload) and prevention of hospital admission for parenteral diuretics.

Group B. Setting: hospital. Aim: weight loss and facilitation of discharge home.

Group C. Setting: hospice. Aim: stabilizing the condition (weight loss and improvement in clinical signs of fluid overload) and prevention of transfer to hospital for parenteral diuretics.

Group D. Setting: hospice. Aim: prevention of symptoms of terminal pulmonary oedema during the dying phase.

Results

The case notes for 32 patients were reviewed (21 men; 11 women). CSCI furosemide was used for 43 patient episodes of fluid overload. When these episodes occurred, the patients' HF severity was classified as New York Heart Association class III for eight episodes and IV in 35. The median number of days per episode of CSCI furosemide was 10.5 (range 2–48; interquartile range (IQR) 6.8–13.8). A summary can be seen in Table 1.

Overall, the aims achieved were as follows:

- prevention of hospital admission or transfer/facilitation of home discharge: 26/28 (93%);
- stabilization of fluid overload: documented weight loss in 20/28 (70%) (median weight loss: 5.6 kg [IQR 0.1–8.9]);
- prevention of symptoms during the dying phase; 15/15 (100%).

Group A

Twelve out of 14 (86%) patient episodes resulted in an avoided hospital admission. The two hospital admissions were for further monitoring, although the patient was losing weight with the CSCI furosemide. One further patient lost weight but required admission to the hospice for *pain control*.

There was documented weight loss for 10/14 (70%) patient episodes, in two, there was no documentation of weight. One patient had stable weight, but died suddenly at home. One patient gained weight but opted to stay at home.

Nine patient episodes resulted in an avoided admission *and* a documented improvement in breathlessness. In nine there was documented improvement in either peripheral oedema or ascites, but not always in the same patients with documented improved breathlessness. In general, documentation of symptoms and clinical signs was not consistent.

Group B

There were only two patient episodes in this group and both achieved the aim of being discharged from hospital to the community with a CSCI of furosemide in situ, one via the hospice. Weight loss and symptom improvement data were only available for one. He lost 5 kg in weight and an improvement in both breathlessness and peripheral oedema was noted. Although there was no data about weight loss or symptoms for the other patient, hospital readmission was avoided.

Group C

No patient episode in this group resulted in a hospital admission. There were 9/12 (75%) documented episodes of weight loss. Two patient episodes had no

Table 1. Patients for whom the aim was stabilization of condition and prevention of hospital admission/transfer/facilitation of home discharge (A: community; B: hospital; C: hospice)

Group setting	Weight loss (kg) (Median (range) IQR)	Achieved goal	Improved SOB	Improved oedema/ascites	Average daily dose furosemide (mg) Mean (range)
A	*N* = 10	12	9	9	142 (80–240)
N = 14	8.8 (0–14.5) 2.0–10.3				
B	*N* = 1	2	1	1	109 (40–120)
N = 2	5				
C	*N* = 9	12	7	5	138 (80–250)
N = 12	6.3 (0.1–8.9) 3.8–8.4				

second measure of weight, because although the patients were admitted with the aim of stabilizing their condition, they deteriorated rapidly and died. One patient gained 0.5 kg weight. There was documented improvement in breathlessness for seven patient episodes, and documented improvement in peripheral oedema in five.

Group D

None of the patients experienced terminal breathlessness, and as such, all 15 were counted as having achieved the goal. Weight measurement was not done as these patients were dying. Symptom assessment was taken from the assessment charts used in the Liverpool care pathway for the dying. In one episode, there was one recording of respiratory secretions documented as a variance, however, this had resolved by the following measurement.

Site reactions

Site reactions occurred in 10/43 (23%) episodes. All except two were mild and managed by changing the site. One, in Group C, was troublesome, causing repeated problems with the infusion site throughout the infusion period and resulting in the patient requiring oral antibiotics. The second, in Group D, was another patient who had a single recurrence of a previous site reaction during the same infusion period.

In general site reactions were more common in the patients as they became less well:

Group A: mild reaction was noted for 1/14 only of the patient episodes;
Group B: no reactions;
Group C: reactions in 3/12 episodes; single and mild reactions in two, and in one, this was the severe, repeated reaction resulting in the requirement for antibiotics;
Group D: reactions in 6/15; single and mild reactions in five, and a recurrent reaction in one.

Discussion

This preliminary experience suggests that for selected patients with advanced CHF who wish to avoid hospital admission but who need parenteral diuretic, CSCI furosemide may be useful in supporting their preferred place of care. HFNSs have been found to be effective in increasing community rather than acute care for people with CHF.[22] In our integrated cardiology-palliative care team, they clearly acted as key workers in identifying and monitoring patients who were appropriate for CSCI furosemide in the community or hospice. Careful patient selection and informed preference of place of care are crucial pre-requisites for this approach.

An alternative approach is to increase the availability of IV loop diuretic administration in the community; there are new initiatives for HFNSs to provide home IV services for such precarious patients. However, the British Heart Foundation report shows that HFNSs only see 34% of patients known to have CHF in any one Primary Care Trust, and each nurse carries an active case load of approximately 60 patients.[23] The situation appears to be both inequitous and unsustainable for a valuable and crucial patient resource. CSCI furosemide may address some of these issues. Syringe drivers are familiar to all trained district nurses, and are available in all community settings. Thus this would seem to be an excellent use of the HFNSs' time and expertise, identifying and monitoring patients rather than in administration of diuretic.

Another important issue that arises from the possibility of CSCI furosemide is that whilst some UK hospices are less familiar with continuous IV infusion of medication, all are familiar with CSCIs. As it can be difficult to tell whether a CHF patient's deterioration is the one that will lead to their death, then having a hospice that is able to provide parenteral infusion of diuretic may then improve the choice of place of care and death for people with CHF.

The main weakness of this report, of course, is that of any retrospective case note review, dependent as it is upon the quality and consistency of documentation, especially with a variety of clinicians and settings. In addition, clinical estimates of peripheral oedema, jugular venous pressure height and the presence of basal crepitations are particularly open to large variation and interpretation. However, even where the weight was measured by the patient or carer at home, we feel that weight change is a reasonably objective measure given that the avoidance of hospital admission, or facilitation of home discharge achieved by patients in groups A–C, are significant patient-relevant outcomes worth further study. In a future planned study, weight measurement would be standardized with calibrated scales and weighing performed by research staff for further accuracy.

The other weakness is inherent with any design without a control group. We therefore cannot exclude other factors from being instrumental in

supporting these patients in their preferred place of care. All patients were closely supervised as part of a well integrated HF-palliative care service and received optimization of all diuretic therapy, not just the loop diuretic; any contribution from the CSCI furosemide is therefore difficult to isolate. However, this data is important, and can inform the design of future study designs with a control arm.

For Group D, we cannot assess whether the use of CSCI furosemide played any role in patient care. Further work in this area would need a randomized controlled study comparing CSCI with IV furosemide. In addition, given that the role of diuretics in the last few days of life in the face of worsening renal failure and increasing diuretic resistance is unclear, a case could be made for an additional placebo arm. This area is further complicated by potential difficulty in distinguishing pulmonary oedema from the retained secretions commonly seen in those dying of any cause, although given that the one patient in this series had a single episode of quickly resolving discomfort makes pulmonary oedema unlikely.

The subcutaneous route was well tolerated for the most part, although one patient in particular had recurrent problems and there was a suggestion that problems became more frequent in those who were more unwell, despite there being no obvious difference in the daily dose of CSCI furosemide received between community patients and those who were dying (see Table 1). The site reaction rate is in keeping with that previously documented in the literature (9%–48%).[24,25]

Conclusion

CSCI of furosemide for selected patients with advanced HF who are not imminently dying appears to be an effective route of parenteral diuretic in terms of weight loss and prevention of hospital admission. It was well tolerated as part of an overall management plan. As the majority of community and hospice nurses have access to and are familiar with CSCI pumps, this practice should be transferable across the UK. The role in the dying patient, if any, requires further assessment. Further work in the future should compare IV therapy with CSCI, and how community use of CSCI furosemide compares with other practice, such as escalation of oral diuretic therapy, to allow greater understanding of the relative effectiveness of each method of administration and management options.

Acknowledgements

We are grateful for the support of Dr Bob Clark, consultant cardiologist (acute) at the Acute Scarborough and North Yorkshire NHS Healthcare Trust; the district nurses of North Yorkshire and York Primary Care Trust; the staff of St Catherine's Hospice and Tracey Hawkes, data manager.

Funding statement

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests

The authors declare that they have no competing interests.

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