An Advanced Chronic Heart Failure Day Care Service: A 5 Year Single-Center Experience*

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ABSTRACT: **Background:** Chronic heart failure is associated with excessive hospitalizations and poor prognosis.

Objectives: To summarize the 5 year experience of a single-center CHF day care service, detect the cardiovascular and non-cardiovascular events, and evaluate the safety of the treatments provided.

Methods: We retrospectively studied all patients admitted to the CHF day care service of the Sheba Medical Center between September 2000 and September 2005.

Results: Advanced (New York Heart Association class III-IV) CHF patients (n=190), mean age 65 ± 12 years and left ventricular ejection fraction 25 ± 11%, were treated for 6 hourly biweekly visits; 77% had ischemic and 23% had non-ischemic cardiomyopathy. Treatment included: intravenous diuretic combinations (91%), intermittent low dose (≤ 5 µg/kg/min) dobutamine (87%), low dose (≤ 3 µg/kg/min) dopamine (38%), intravenous iron preparation and/or blood (47%), and intravenous nitropruside (36%). Follow-up of at least 1 year from initiation of therapy was completed in 158 of 190 patients (83%). Forty-six (29.3%) died: 23% due to CHF exacerbation, 5.7% from infection, 4.4% from sudden cardiac death, 3.8% from malignancy, 2.5% from malignant arrhythmias, 1.9% from renal failure, 1.3% from stroke, and 0.6% from myocardial infarction. There were only 0.68 rehospitalizations/patient/year; the most frequent cause being CHF exacerbation (16.5%).

Conclusions: Our study demonstrates the safety and potential benefits of a supportive day care service for advanced CHF patients. Multidrug intravenous treatment, accompanied by monitoring of electrolytes, hemoglobin and cardiac rhythm, along with education and psychological support, appear to reduce morbidity in advanced CHF patients and may have contributed to the lower than expected mortality/hospitalization rate.

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KEY WORDS: heart failure, prognosis, coronary disease, angina

Chronic heart failure is the only major cardiovascular disease whose prevalence and incidence are thought to be increasing [1] and it has been predicted that the occurrence of CHF may soon reach epidemic proportions [2]. The long-term prognosis of CHF patients is uniformly poor [3-5]. Fifty percent of newly diagnosed patients will die within 4 years, while > 50% with advanced CHF will die within 1 year. More than one-third of CHF patients are hospitalized annually [2,6].

The economic impact of heart failure and the burden of the disease on patients and their caregivers are high despite advances in pharmacological therapy, sophisticated pacemakers and defibrillators, and surgical corrective procedures [7]. Advanced heart failure patients [8] who remain in New York Heart Association class III-IV despite optimal treatment are usually considered for heart transplantation. However, due to limited viable organs worldwide and an aging population beyond the limit of heart transplantation, many advanced CHF patients do not benefit from this ultimate surgical procedure. These severely ill patients suffer from multiple symptoms, of which fatigue and dyspnea are the most troubling [7], rendering their quality of life particularly poor. The discomfort, distress and mortality are in fact comparable to those of terminal cancer patients [1].

In 2000 an intensive CHF day care service was established at the Heart Institute of the Sheba Medical Center in order to improve the care of advanced CHF patients, including those awaiting heart transplantation. The aim of the present study was to summarize the 5 year (2000–2005) experience of a single-center CHF day care service to detect the cardiovascular and non-cardiovascular events occurring in patients treated within the framework of this day care facility, and to evaluate the safety of the treatments provided.

CHF = chronic heart failure

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PATIENTS AND METHODS

We retrospectively analyzed all consecutive patients admitted to the CHF day care service of the Sheba Medical Center between September 2000 and September 2005. Inclusion criteria included men and women aged at least 20 years with chronic advanced CHF (NYHA class III-IV) who were referred to this day care clinic after being evaluated by a heart failure specialist from our Heart Institute. Excluded were patients with unstable angina, a history of heart surgery or acute myocardial infarction of ≤ 3 months, uncontrolled systemic hypertension > 180/110 mmHg, malignant ventricular arrhythmias on 24 hour Holter monitoring, history of current drug or alcohol abuse, inability to participate in the program, non-compliance, ongoing infection or immediate life-threatening extracardiac disease or malignancy.

All data from the medical charts of patients participating in the CHF day care service were documented into a computerized data sheet, and were updated by the medical staff at each patient's scheduled or non-scheduled visit. The computerized data included the patient's medical history, coronary artery disease risk factors, medical history and concomitant therapy, laboratory results, and all invasive and non-invasive procedures. The CHF day care database included follow-up by the head CHF nurse and staff CHF cardiologist for each patient enrolled in the program, including hospitalization data retrieved after verification from the hospital discharge report. Clinical events were recorded, such as cerebrovascular accident, all-cause mortality, sudden cardiac death and hospitalizations due to CHF exacerbation, angina pectoris, arrhythmias, MI, or infection.

HEART FAILURE DAY CARE PROTOCOL

Patients with heart failure due to ischemic heart disease, dilated cardiomyopathy, valvular heart disease, hypertensive heart disease or congenital etiology were documented. Before patients entered the program oral medications were up-titrated to the highest tolerated dose according to the American College of Cardiology/American Heart Association/European Society of Cardiology CHF guidelines [9,10]. Biventricular pacemaker or implantable cardioverter defibrillator was implanted when needed. The day care service staff included intensive cardiac care unit nurses specialized in CHF care, and senior cardiologists specialized in CHF working in the CHF program.

All CHF patients referred to the CHF day care service and suffering from symptomatic volume overload had at least one recent hospitalization for decompensated heart failure and showed an unsatisfactory response to intravenous diuretics during hospitalization or ambulatory care.

At their first visit, lifestyle, habits and medications were thoroughly reviewed, and patients and their families underwent comprehensive orientation and guidance with regard to living with heart failure. Patients received information about heart failure, medications, self-management of signs and symptoms, low salt diet and fluid recommendations. Treatment schedule was based on one to two visits/week, and included a 6 hour intravenous infusion of furosemide and positive inotrope or vasodilator agents. The preferred agent was dobutamine started at 3 μg/kg/min and increased to 5 μg/kg/min. Dopamine 1–3 μg/kg/min was given for dobutamine intolerance and to patients with advanced renal failure and inadequate urinary response. Dopamine could be increased to 5 μg/kg/min in patients with low blood pressure whose urine output appeared to be blood pressure dependent. Nitroprusside, up to 60 μg/min (given alone or in combination with positive inotropic), was the preferred agent for symptomatic right heart failure, in the presence of pulmonary hypertension or severe mitral regurgitation. Nitroprusside was used as a single additional drug in patients with CHF and significant angina. Nesiritide was given to those who were non-responsive or intolerant to nitroprusside and inotropes. The drug was started with a bolus of 1 μg/kg followed by an infusion of 0.01 μg/kg/min, but the bolus was skipped in those patients with low blood pressure (< 100 mmHg systolic).

During each session, heart rhythm, blood pressure, capillary oxygen saturation and urine output were continuously monitored. Body weight was registered at the beginning and end of every visit. Renal function tests and electrolytes were determined at each visit. Blood count and coagulation tests were obtained on a weekly basis. Complete blood chemistry, serum iron, thyroid function tests and digoxin levels were determined once a month.

Oral metolazone, 2.5 mg, was added to those with excessive weight gain. Red blood cells, intravenous iron, potassium and magnesium were administered as required. Patients with signs of cachexia received intravenous multivitamin supplements and a special diet. Consultations with individual heart failure specialists, nephrologists, electrophysiologists, dieticians and other medical professionals were provided on site as required.

Patients continued to attend the day care sessions as long as they had a) symptomatic benefit from therapy, and b) remained in NYHA class III-IV and required intravenous therapy for their clinical stability. Once patients stabilized to NYHA functional class III, the number of visits was gradually decreased (down to two a month), with the objective of weaning them off intravenous therapy. Patients discontinued attendance if they underwent heart transplantation.

NYHA = New York Heart Association
MI = myocardial infarction

Table 1. Baseline characteristics of study population (n=190)

Age (yrs)	65 ± 12*	**Laboratory values on admission**	
Body mass index (kg/m^2)	27 ± 5	Sodium (mEq/L)	137 ± 4
Body mass index › 30 kg/m^2	39 (21%)	Potassium (mEq/L)	4.5 ± 0.5
Systemic hypertension	74 (39%)	Chloride (mEq/L)	100 ± 6
Diabetes mellitus	90 (47%)	Creatinine (mg/ml)	1.7 ± 0.7
Current smokers	0	Phosphate (mg/ml)	3.8 ± 0.7
Past smokers	102 (54%)	Calcium (mg/ml)	9.3 ± 0.5
Hypercholesterolemia	104 (55%)	Total cholesterol (mg/ml)	146 ± 38
Family history of ischemic heart disease	53 (28%)	Triglycerides (mg/ml)	131 ± 104
Left ventricular ejection fraction	25 ± 11%	Low density lipoprotein (mg/ml)	85 ± 28
Left ventricular ejection fraction ‹ 30%	161 (85%)	High density lipoprotein (mg/ml)	35 ± 10
Concomitant medications on admission		Homocysteine (mg/ml)	20 ± 8
β-receptor antagonists	136 (72%)	Thyroid-stimulating hormone (μU/ml)	4.4 ± 4.8
α-receptor antagonists	24 (13%)	Total triiodothyronine (nmol/L)	1.5 ± 0.5
Coumadin	80 (42%)	Free thyroxine (pmol/L)	16.3 ± 3.2
Diuretics	184 (97%)	Testosterone (μg/L)	3.1 ± 1.8
Aspirin	160 (84%)	High sensitivity C-reactive protein (mg/L)	19.8 ± 29.7
Long-acting nitrates	100 (53%)	ProBNP (pg/ml)	7376 ± 10290
ACE/ARB inhibitors	137 (72%)	Hemoglobin (g/dl)	12.4 ± 1.7
Lipid-lowering agents (statins)	90 (47%)	Hematocrit (%)	38 ± 5
Amiodarone	51 (27%)	Platelets (K/μl)	213,000 ± 75,000
Digoxin	106 (56%)	Iron (μg/dl)	57 ± 24
Anti-diabetic medications	70 (37%)	Vitamin B_{12} (pg/ml)	635 ± 370
Vitamins and supplements	52 (27%)		
Iron preparations	19 (10%)		

*Values are expressed as mean ± SD
ACE = angiotensin-converting enzyme, ARB = angiotensin-receptor blocker

STATISTICAL ANALYSIS

Baseline characteristics of the study population are expressed as mean ± SD for continuous variables and as frequencies and percentages for categorical variables. Differences between clinical characteristics in CHF patients who either survived or died were generated by using the independent *t*-test or chi-square test for continuous or categorical variables, respectively. The impact of various variables on outcome (hospitalizations, mortality) was measured using a multiple logistic regression model (to detect the independent impact of each variable). Kaplan-Meier curve was conducted to demonstrate the proportion of survivors over time in 158 severe CHF patients with follow-up of at least 1 year (83% of the study cohort). A *P* value of < 0.05 was considered significant.

RESULTS

Our study population comprised 190 advanced (NYHA class III-IV) CHF patients, 168 (89%) males, with a mean age of 65 ± 12 years (range 29–89) and mean body mass index of 27.4 ± 4.9 kg/m^2. Most (85%) patients had severe left ventricular dysfunction (left ventricular ejection fraction ≤ 30%) and the mean LVEF was 25 ± 11%.

Ischemic and non-ischemic cardiomyopathy was found in 147 (77%) and 43 (23%) patients, respectively. Isolated left-sided CHF was detected in 56 patients (29.5%), right-sided in 8 (4.2%) and combined left and right CHF in 126 (66.3%). Of the 41 heart transplant candidates (22%), 20 actually underwent transplantation.

Baseline clinical characteristics, including CAD risk factors, co-morbidities and concomitant medical therapy given during CHF day care service, as well as laboratory parameters on admission, are summarized in Table 1. Of the 190 patients treated in the CHF day care service, 28 (15%) had ICD pacemakers, 39 (20%) had other pacemakers and 13 (7%) had malignancies.

Most patients (95%) received intravenous diuretic therapy,

LVEF = left ventricular ejection fraction
CAD = coronary artery disease
ICD = implantable cardioverter defibrillator

Table 2. Comparison of continuous variables between patients who survived and patients who died

Variables	Survivors (n=104)	Deaths (n=86)	*P* value
Age (yrs)	64 ± 13*	66 ± 11	0.14
BMI (kg/m²)	27.8 ± 5.3	26.9 ± 4.2	0.18
Sodium (mEq/L)	138 ± 3	136 ± 5	0.15
Potassium (mEq/L)	4.5 ± 0.5	4.4 ± 0.5	0.16
Chloride (mEq/L)	101 ± 6	98 ± 6	0.16
Creatinine (mg/dl)	1.63 ± 0.7	1.8 ± 0.7	0.07
Phosph (mg/dl)	3.8 ± 0.6	3.7 ± 0.7	0.94
Calcium (mg/dl)	9.4 ± 0.5	9.3 ± 0.5	0.30
Total cholesterol (mg/dl)	152 ± 39	140 ± 37	0.03
Triglycerides (mg/dl)	139 ± 79	120 ± 129	0.24
LDL-C (mg/dl)	88 ± 28	82 ± 28	0.19
HDL-C (mg/dl)	36 ± 10	34 ± 11	0.20
Homocysteine (µmol/L)	19.5 ± 6.0	22.4 ± 10.0	0.13
TSH (µU/ml)	3.6 ± 2.9	6.2 ± 6.6	0.001
Triiodothyronine (nmol/L)	1.65 ± 0.5	1.27 ± 0.5	< 0.001
Thyroxine (pmol/L)	16.4 ± 2.8	16.2 ± 3.7	0.76
Testosterone (µg/L)	3.5 ± 1.8	2.4 ± 1.6	0.05
hs-CRP (mg/L)	14.7 ± 23.0	25.7 ± 35	0.068
ProBNP (pg/ml)	4753 ± 5419	15,247 ± 16,245	< 0.001
Hemoglobin (g/dl)	12.5 ± 1.7	12.3 ± 1.7	0.25
Hematocrit (%)	38 ± 5	38 ± 5	0.77
Platelets (/µL)	219 ± 69	206 ± 82	0.23
Ferrum (µg/dl)	57 ± 21	57 ± 28	0.97
Vitamin B_{12} (pg/ml)	605 ± 341	698 ± 425	0.28

*Values are expressed as mean ± SD

BMI = body mass index, HDL-C = high density lipoprotein cholesterol, LDL-C = low density lipoprotein cholesterol, TSH = thyroid-stimulating hormone, hs-CRP = high sensitivity C-reactive protein, ProNP = pro B-type natriuretic peptide

Normal values: homocysteine 5–15 µmol/L, thyroid hormone 0.4–4 µU/ml, Total triiodothyronine 1.3–2.7 nmol/L, free thyroxine 10–25 pmol/L, testosterone 1.8–8 µg/L, CRP 0–5 mg/L, ProBNP 5–852 pg/ml, ferrum 60–170 µg/dl, vitamin B12 181–1059 pg/ml.

84% low dose (≤ 5 µg/kg/min) dobutamine, 49% low dose (≤ 3 µg/kg/min) dopamine and 10% nesiritide. Most patients also received supplemental potassium (78%), magnesium (70%) or multivitamins (60%). Intravenous iron was given to 28%, blood to 18% and nitric oxide inhalations to 6%. In addition, we performed intermittent thoracentesis in 4% and peritoneal paracentesis in 11% of the patients.

NYHA class improved significantly from III-IV to II in 49 of the 190 patients (26%), enabling them to return to their previous active daily work.

During the 5 year follow-up, there were 111 hospitalizations in 30% of the study population (mainly due to CHF exacerbation), representing a total rate of 0.68 hospitalizations/patient/year. Other causes of hospitalizations were: infectious disease in 28 patients (14.7%), arrhythmias in 14 (7.4%), angina pectoris in 7 (3.7%), MI in 4 (2.1%) and stroke in 2 (1.1%).

Table 3. Comparison of categorical variables between patients who survived and those who died

Variable	Survivors (n=104)	Deaths (n=86)	*P* value
Females Males	16 88	6 80	0.10
Recurrent patient	9 (9%)	6 (7%)	0.67
Ischemic cardiomyopathy	81 (78%)	66 (77%)	0.85
Non-ischemic cardiomyopathy	22 (21%)	20 (23%)	0.72
NYHA class IV	27 (26%)	14 (16%)	0.53
Heart transplant candidates	7 (7%)	6 (7%)	0.10
Heart transplantations	13 (13%)	7 (8%)	0.33
Hypertension	38 (37%)	36 (42%)	0.45
Dyslipidemia	65 (63%)	39 (45%)	0.01
Smokers	57 (55%)	45 (52%)	0.73
Diabetes mellitus	53 (51%)	37 (43%)	0.27
Obesity (> 30 kg/m²)	27 (26%)	12 (14%)	0.04
Family history of CAD	27 (26%)	26 (30%)	0.51
ICD pacemakers	11 (11%)	17 (20%)	0.07
NSYNC pacemakers	8 (8%)	5 (6%)	0.61
DDD pacemakers	13 (13%)	4 (5%)	0.05
VVI pacemakers	2 (2%)	7 (8%)	0.04

CAD = coronary artery disease, DDD = dual chamber pacemaker, ICD = implantable cardioverter defibrillator

There were no fatal events during the active therapy in the CHF day care service. Within the first month of enrollment into the program 47 of the 190 patients (24.7%) died, accounting for 54.6% of all mortality. Afterwards mortality dropped gradually.

For 158 (83%) of the study population the follow-up period exceeded 1 year, identifying a subgroup of patients who stabilized as a result of the day care service treatment. In these patients the mortality rate was 29% (46/158). The main cause of death was CHF exacerbation (23%) followed by infection (5.7%), sudden cardiac death (4.4%), malignancy (3.8%), malignant arrhythmia (2.5%), renal failure (1.9%), stroke (1.3%) and MI (0.6%).

The difference in various parameters between those who died and those who survived is summarized in Tables 2-4. Hyperlipidemia and obesity were more common in patients who survived, while VVI pacemaker was significantly more prevalent in those who died [Tables 2 and 3]. Serum levels of total cholesterol and triiodothyronine hormone on admission to the CHF day care service were significantly higher in those who survived, while thyroid stimulating hormone and pro-brain natriuretic peptide were significantly higher on admission in those patients who died [Table 2].

Among concomitant oral medications on admission, the use of β-receptor blocking agents, statins and angiotensin-converting enzyme inhibitor/angiotensin receptor blockers were more common in those who survived compared to those who died [Table 4].

The frequency of any diuretic therapy given at the CHF day care service, particularly intravenous furosemide and intravenous nesiritide, was significantly more common in those who survived compared to those who died, while intravenous vitamin supplementation and the need for pleural or peritoneal fluid drainage were more common in those who died [Table 4].

Hospitalization for CHF exacerbation or any cardiovascular event was more common in patients who died than in those who survived.

Table 4. Comparison of concomitant therapy between patients who survived and those who died prior to day care service admission and during day care service

	Survivors (n=104)	Deaths (n=86)	*P* value
Prior to admission to day care service			
Diuretics	99 (95%)	85 (99%)	0.15
ACE/ARB inhibitors	82 (79%)	55 (64%)	0.02
β-receptor blockers	84 (81%)	52 (61%)	<0.01
α-receptor blockers	9 (9%)	15 (17%)	0.07
Statins	58 (56%)	32 (37%)	0.01
Amiodarone	24 (23%)	27 (31%)	0.19
Long-acting nitrates	55 (53%)	45 (52%)	0.93
Digoxin	56 (54%)	50 (58%)	0.55
Platelet inhibitors	91 (88%)	69 (80%)	0.17
Anti-diabetic agents	41 (39%)	29 (34%)	0.41
Vitamins	27 (26%)	25 (29%)	0.63
Ferrum	9 (9%)	10 (12%)	0.49
Day care service therapy			
Dobutamine	83 (80%)	76 (88%)	0.11
Nesiritide	15 (14%)	3 (4%)	0.01
Nitropruside	37 (36%)	31 (36%)	0.94
Dopamine	47 (45%)	46 (54%)	0.25
Any diureric	96(92%)	85 (99%)	0.03
Furosemide	96 (92%)	85 (99%)	0.03
Metolazone	49 (47%)	50 (58%)	0.13
Magnesium	77 (74%)	56 (65%)	0.18
Potassium	80 (77%)	68 (79%)	0.72
Nitric oxide	4 (4%)	8 (9%)	0.12
Ferrum	31 (30%)	22 (26%)	0.51
Blood	16 (15%)	19 (22%)	0.23
Vitamins	50 (42%)	64 (74%)	< 0.01
Thoracentesis	0 (0%)	7 (8%)	< 0.01
Peritoneal paracentesis	4 (4%)	17 (20%)	< 0.01

ACE = angiotensin-converting enzyme, ARB = angiotensin receptor blocker.a

DISCUSSION

The present study summarizes 5 years of activity in a CHF day care service in an Israeli medical center, providing, for the first time, long-term follow-up and analysis of treatment and safety of advanced CHF patients in such a facility. The intravenous treatment in the day care service was individually adjusted to each patient's needs, and close monitoring of electrolytes, liver function, renal function and hemoglobin levels was conducted.

During the last two decades CHF therapy has undergone profound changes. Current therapy focuses not only on reduction of mortality but also on arresting disease progression and symptom alleviation, preventing functional deterioration and hospitalizations [11].

Advanced CHF patients (NYHA class III-IV) are frequently hospitalized for CHF exacerbation. The relatively high morbidity and mortality rates in these severely ill patients led to the initiative of establishing specially designed CHF clinics in many medical centers, some of which included CHF day care clinics. In these facilities advanced CHF patients, who had become refractory to conventional oral therapies, could receive intermittent intensive, mostly intravenous, treatment.

Our data suggest an enduring benefit on survival and hospitalizations for advanced heart failure patients treated in a day care service. The annual mortality rate among patients treated in the day care service was significantly lower (29%) than that reported in the literature (50%) [2,6]. Similarly, the hospital admission rate was also remarkably low (0.6 hospitalizations/patient/year) compared to that reported in the literature [12].

Our study population included high risk advanced CHF patients with poor laboratory prognostic predictors, such as low serum sodium and relatively high proBNP levels. These laboratory findings in CHF patients usually carry a 50% one year mortality rate [13]. We believe that the intensive and multidisciplinary treatment that our patients received in the CHF day care service successfully reduced their one year mortality rate to a relatively low 29%.

Along with the lower than expected mortality rate in the current study, CHF hospitalization rate was also lower than expected. In a 5 year follow-up the CHF hospitalization rate in the current study cohort (0.68/patients/year) was significantly lower than that reported by the DICE Multicenter Trial (0.5/patient/6 months) [14], or by Elis et al. [15] (2.2/patients/6 months). In addition to the deleterious effects of

BNP = brain natriuretic peptide

rehospitalizations on the quality of life of CHF patients, one cannot ignore the significant cost-effective impact [16].

Despite the fact that most of the patients were treated with either dobutamine or dopamine, or a combination of these two medications, their course was relatively safe without mortality, most probably due to the relatively low dose therapy used compared with previous reports, and the close monitoring of patients' electrolytes and heart rhythm.

About 84% of the study cohort received intermittent intravenous dobutamine (≤ 5 μg/kg/min). As previously reported by others [17], we could not conclude that dobutamine alone improved survival compared to other administered therapies. Nevertheless, our study did not indicate that dobutamine led to increased mortality or morbidity as previously demonstrated [18]. Intravenous dobutamine therapy of up to 5 μg/kg/min, as given in our day care clinic and also by Miller and co-workers [19], was shown to have a mainly vasodilator effect, whereas doses above 5 μg/kg/min predominantly have an inotropic effect [20]. Previous smaller clinical trials [21,22] demonstrated that intermittent intravenous dobutamine therapy (≤ 5 μg/kg/min) improved functional capacity and reduced hospitalizations and cost by 16%. Our group recently demonstrated that short-term (4 months) intermittent intravenous dobutamine therapy (≤ 5 μg/kg/min) significantly improved brachial artery endothelial function, as well as systemic vascular resistance, cardiac index and stroke index, in the same patient population treated in the CHF day care service [23].

Furthermore, 49% of the study cohort received intermittent intravenous therapy of low dose (≤ 3 μg/kg/min) dopamine, 42% a combination therapy of dobutamine and dopamine, or 28% dobutamine and nitropruside. None of these therapies was found to independently impact survival, and there was no significant effect regarding the use of these therapies in those who did or did not survive. In the current study, however, we found that the use of intermittent intravenous therapy with either dobutamine or dopamine alone or in combination was safe and was not associated with increased sudden cardiac or arrhythmic death. The commonly accepted view as reported in the literature [24] is that about half of all severe CHF deaths are sudden and mostly related to arrhythmias, whereas only 2.5% of those who died in the current study suffered sudden cardiac death attributed to arrhythmias.

Most of our patients had anemia (median hemoglobin 12.4 g/dl), about 18% needed blood transfusions and 28% needed iron preparations. Anemia has been shown to be an independent predictor of morbidity and mortality in CHF patients, regardless of their NYHA class [25], while anemia correction improves prognosis. Nevertheless, in the current study neither anemia alone nor anemia correction was found to impact survival.

The beneficial effect of a CHF day care service may also be attributed to disease management afforded by the dedicated CHF personnel, who closely monitored and provided constant intensive care, support and education to both the patients and their families.

STUDY LIMITATIONS

We evaluated a relatively small number of advanced CHF patients in a prospective observational study without a control group. It should be noted that there was a potential for treatment bias since the investigators knew the exact treatment the patients would receive. However, since most patients received the same treatment according to protocol-guided therapy, and since the entire CHF day care service staff did not change throughout the study period and the treating protocols remained almost the same, potential bias was limited to a minimum.

CONCLUSIONS

Our study demonstrates the beneficial effects of a day care service that intensively supports severe, advanced CHF patients. Multidrug therapy and intensive care monitoring of electrolytes, hemoglobin and cardiac rhythm, in addition to education and psychological support, facilitate patients' active daily living and may contribute to the lower than expected rate of mortality and hospitalizations. Although intermittent intravenous treatment in a CHF day care service is relatively safe, further prospective studies are needed to evaluate the impact of various treatment strategies on survival, hospitalizations and quality of life in these patients.

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