Survival Benefit in Patients with Heart Failure Treated in Specialized Heart Failure Center within the Community

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ABSTRACT:

Background: Heart failure centers with specialized nurse-supervised management programs have been proposed to improve prognosis. A heart failure center in Beit Shemesh, Israel, is located within a large primary care facility. The specialist team supervised the managememt of patients both within the frame of the center and while they were hospitalized.

Objectives: To evaluate the health services utilization by heart failure patients treated at a heart failure center and their clinical outcome.

Methods: In this retrospective study, we compared the clinical outcome of patients treated at a heart failure center to patients who received the usual care in 2013–2014. The clinical outcome included primary care visits, emergency room visits, hospitalizations, and death.

Results: The study comprised 430 heart failure patients; 82 were treated at a heart failure center and 348 under usual care. At baseline, no significant differences were seen in clinical parameters between the groups. Healthcare utilization was higher among the study group. No significant changes in healthcare utilization were found. During follow-up, patients treated in the heart failure center were more likely to get recommended heart failure medications. Mortality was significantly lower in patients treated in a heart failure center compared with those receiving usual care 3.6% vs. 24%, respectively ($P = 0.001$), hazard ratio 0.19, 95% confidence interval 0.06–0.62, $P = 0.005$.

Conclusions: Joint management of heart failure by primary clinics and a specialized community heart failure center reduced mortality. There was no decrease in healthcare utilizations among heart failure center patients, despite the reduction in mortality.

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KEY WORDS: community care, coordinate care, heart failure, mortality, specialized heart failure centers

Heart failure has emerged as an epidemic and is now a significant public health burden worldwide [1]. It is associated with considerable high morbidity and mortality [2]. The total cost of heart failure management is enormous, and is expected to double in the next decade [3]. The majority of the costs attributed to heart failure are related to hospitalization [4]. Heart failure centers with disease management programs under specialized nurse supervision are proposed to improve prognosis and reduce hospitalizations. A multidisciplinary heart failure center in Jerusalem reduced hospitalization rates but not mortality [5]. Reduction in hospitalizations was also shown in a nurse-led heart failure management program in France [6]. However, as these management programs differ among centers and are largely dependent on the available health infrastructure, the clinical outcome and success of the programs varies.

The purpose of the present study was to evaluate the clinical impact of a unique heart failure center in the city of Beit Shemesh, Israel. The city has approximately 100,000 residents and is ranked 2/10 on the socioeconomic cluster index. Despite the proximity to Jerusalem, elderly patients prefer to use local medical services and avoid the efforts required to travel to Jerusalem. The heart failure center is located within a large primary care facility and the heart failure specialist team supervises the management of the patients both within the frame of the heart failure center and while they are hospitalized.

We evaluated the clinical outcome and health services utilization of heart failure patients receiving usual care (control group) compared to those treated in our heart failure center.

PATIENTS AND METHODS

The heart failure center in Beit Shemesh opened at the end of December 2012 and is located within a local primary care clinic. The center serves patients from the Beit Shemesh area insured by Clalit, the largest health fund in Israel. The heart failure center includes two cardiologists and a trained nurse, who is also part of the primary care clinic team. Patients and

their accompanying family members receive routine guidance about the disease, including self-management and ways to avoid exacerbations. Patients receive recommended lifesaving heart failure therapies based on the current European Society of Cardiology (ESC) guidelines, including all drug therapies, interventions, and device therapies [7]. Patients also receive intravenous medications at the center, primarily diuretics or parenteral iron replacement therapy. The family physicians receive a summary of each visit to the center and had direct access to consultation with the specialist. The heart failure specialist follows the patients who required hospitalization in the nearest hospital, providing continuous medical care during and following hospitalization.

The study comprised all patients 40 years with heart failure within the Beit Shemesh area who were alive by the end of January 2013. Patients were included in the study group if they visited the heart failure center at least once between 2013 and 2014. Patients were referred to the heart failure center by their primary physicians. Heart failure patients who were hospitalized, recently deteriorated, or frequently visited the primary care clinic were more likely to be referred to the heart failure center.

Clalit has a complete digital record of all patients. The records include demographics, comprehensive clinical data, diagnoses, and all laboratory data. The demographic data including mortality is updated directly from the population registry of the Ministry of Interior. Data was retrieved from patient files for the years 2012–2014, including chronic diagnosis, laboratory results, medication purchasing, visits to the primary care clinic and emergency department (ED), hospitalizations, and death.

The patients were divided into two groups: patients treated at the heart failure center and patients who were under usual care. We compared medication use, primary care visits, ED visits, hospitalizations, and mortality between the groups from 2013–2014. We also compared healthcare utilization during 2012, before the center was opened, with the healthcare utilization during 2013–2014, after the opening of the heart failure center.

Statistical analyses were performed using STATA Software for Statistics and Data Science version 8 (Stata Corp. College Station, TX, USA). Comparison of the clinical characteristics was performed using Student's t-test for continuous variables, Chi-square test for categorical variables, and Kruskal-Wallis test for variables without normal distribution. Multivariable Cox proportional hazards regression analysis was used to evaluate independent variables that determined survival. Parameters included in the multivariate Cox regression analysis incorporated significant clinical and laboratory parameters on univariable analysis.

The study was performed in compliance with the local institutional review board of Clalit. Requirement of informed consent was waved (no. 109/2014C).

RESULTS

The study comprised 430 heart failure patients, 82 of whom were treated at the heart failure center and 348 who received usual treatment. Table 1 provides the baseline patient characteristics prior to the opening of the heart failure center (2012). There were no significant differences between the groups in the major parameters including age, risk factors, and previous history of acute myocardial infarction. The patients treated at the heart failure center were from a lower socioeconomic status level (78.0% vs. 43.7%; $P < 0.001$). A total of 34 heart failure center patients (42%) were classified as New York Heart Association (NYHA) functional class III–IV at their first visit to the center. At the last recorded visit at the heart failure cen-

Table 1. Basic demographics and clinical characteristics of the patients

	Control (n=348)	Heart failure center (n=82)	P value
Age (years)	75.5 ± 10.9	74.2 ± 9.7	0.32
Gender (women)	48.0%	49.4%	0.82
Low socioeconomic status (%)	43.7%	78.0%	‹ 0.001
Charlson Comorbidity Index	7.8 3.0	7.4 3.2	0.25
Atrial fibrillation	37.0%	41.4%	0.46
Chronic obstructive lung disease	23.6%	30.5%	0.19
Diabetes mellitus	53.2%	57.3%	0.50
Hyperlipidemia	91.3%	95.1%	0.26
Hypertension	84.2%	89.0%	0.27
Myocardial infarction (s/p)	52.3%	52.4%	0.98
Smoker	24.1%	29.3%	0.34
Systolic blood pressure (mmHg)	127.1 ± 18.3	129.4 ± 15.4	0.30
Body mass index (kg/m2)	29.9 ± 5.7	30.1 ± 6.7	0.74
Low-density lipoprotein (mg/dl)	87.7 ± 32.4	83.7 ± 2 9.2	0.31
Glucose (mg/dl)	117.8 ± 47.8	123.0 ± 50.5	0.40
Hemoglobin (g/dl)	12.7 ± 1.8	12.6 ± 1.6	0.57
Estimated glomerular filtration rate (ml/min per 1.73 m2)*	64.0 ± 25.6	65.1 ± 22.1	0.71
Creatinine	1.05 ± 0.5	1.27 ± 1.3	0.14
Sodium	139.7 ± 3.3	139.7 ± 3.1	0.93
Albumin (g/dl)	3.9 ± 0.4	4.0 ± 0.3	0.15
Number primary care visits during 2012	26.0 ± 17.3	31.3 ± 17.3	0.005
Number of emergency room visits during 2012	0.3 ± 0.7	0.3 ± 0.6	0.86
Percent of patients hospitalized during 2012	40.4%	47.6%	0.24
Number of hospitalizations in 2012	0.9 ± 1.5	0.9 ± 1.3	0.40

Data is presented as mean ± standard deviation for continuous variables and percentages for categorical variables

*Estimated glomerular filtration rate was calculated using the modified Modification of Diet in Renal Disease (MDRD) equation

ter, 50% of the heart failure center patients were classified as NYHA functional class III–IV. NYHA class was improved in 23 patients (28%). The average ejection fraction (EF) of the heart failure center patients was 45.9%. In the heart failure center group, 32 patients (39%) had EF ≤ 40 and 27 patients (33%) had heart failure with preserved EF.

The majority of the patients treated in the heart failure center (85%) had adjustments to their chronic heart failure medications. Patients treated in the heart failure center were more likely to get medications compatible with guideline treatment recommendations for heart failure patients than were patients in the usual care group despite similar medication usage rates at baseline [Table 2]. Among patients with EF < 40%, 80% received beta blockers in 2012 compare to 96% after visiting the heart failure center, and 92% received angiotensin-converting-enzyme inhibitors (or angiotensin II receptor blockers) in 2012 compared to 96% after visiting in the heart failure center.

Patients who were treated at the heart failure center visited the center's cardiologist 5.8 times on average (range 1–20) and visited the center nurse 8.8 times (range 1–38) during the study period.

As shown in Table 3, during follow-up the frequency of visits to primary care physicians significantly decreased in the usual care group (In 2013, P < 0.001 and in 2014, P < 0.0001), but was unchanged in the heart failure center patients. The number of emergency room visits and hospitalizations showed a similar pattern in both groups between 2013 and 2014. Compared to the control group, at baseline patients in the heart failure center group visited their primary care physician significantly more, P < 0.01 [Table 3B]. During the follow-up, patients in the heart failure center group had significantly more primary care physician visits, ED visits, and hospitalizations, compared to the control group.

Survival was significantly higher in patients treated at the heart failure center. Mortality rate during 2013 and 2014 was 3.6% (3/82) in patients treated in the heart failure center

compared to 24% (83/348) in the usual care group (P = 0.001) [Figure 1]. One-year mortality rate was (1/82) 1.2% in the study group and (45/348) 12.9% in the control group. Cox regression analysis demonstrated that treatment in the heart failure center was a predictor of lower mortality (hazard ratio [HR] 0.14, 95% confidence interval [95%CI] 0.04–0.43, P = 0.001). Multivariate Cox regression analysis after adjustment for significant predictors (age, gender, smoking, atrial fibrillation, chronic obstructive pulmonary disease, diabetes mellitus, hypertension, hyperlipidemia, acute myocardial infarction, systolic blood pressure, estimated glomerular filtration rate, low-density lipoproteins, albumin, hemoglobin, and glucose) at baseline demonstrated that treatment at the heart failure center significantly reduced mortality (HR 0.19, 95%CI 0.05–0.62, P = 0.005).

DISCUSSION

The present study demonstrates that treatment at a specialized heart failure center within the community was associated with significantly improved prognosis of heart failure patients. Mortality rate at 2 years in patients treated at the heart failure center was 3.6% compared to 24% for patients treated with usual care. Mortality rates among the patients with usual care were compatible with the mortality rate expected in this disease as reported recently by the ESC Heart Failure Long-Term Registry [8].

Heart failure centers with specialized disease management programs administered under specialized nurse-supervision have been proposed to improve prognosis and reduce hospitalizations [9]. These programs improve care of heart failure patients, increase effective administration of evidence-based strategies, improve structured follow-up, and advance the education of patients and their caregivers in self-care. They are also cost effective over the whole spectrum of patients with heart failure [10]. However, the clinical outcome and success of the programs varies [11]. While most data suggest that some type of healthcare management provides a clinical benefit in patients with heart failure, this is not always the case. A recent nationwide randomized study of a disease management program in Israel did not show better results than usual care of heart failure patients with regard to hospitalizations and mortality [12].

The unexpected low mortality rate among heart failure center patients in the present study was not associated with a change in the number of hospitalizations and ED visits compared to the period preceding their enrollment to the heart failure center. The low mortality was despite the advanced age (mean 74.2 ± 9.7 years), the very high prevalence of class III–IV NYHA patients, and co-morbidities in this population.

The results of this observational study differ from the large Coaching Patients on Achieving Cardiovascular Health (COACH) randomized trial [13], which showed that a nurse-supervised disease management program tended to reduce

Table 2. Pharmacological treatment of patients with heart failure according to study group

	Baseline (2012)			Study period		
	Control (n=348)	Heart failure center (n=82)	P value	Control (n=348)	Heart failure center (n=82)	P value
ACE-I or ARB	81.3%	87.8%	0.16	80.1%	92.7%	0.007
Beta blockers	73.3%	82.9%	0.07	76.7%	95.1%	0.0002
Spironolactone	29.9%	35.4%	0.33	34.7%	70.7%	‹ 0.0001
Furosemide	56.3%	62.2%	0.33	61.5%	80.5%	0.001
Statin	80.2%	86.6%	0.18	77.5%	92.7%	0.002
Anti-coagulant	26.1%	42.7%	0.003	52.7%	76.5%	0.01

ACE-I = angiotensin-converting enzyme inhibitor, ARB = angiotensin receptor blocker

Table 3. Health care utilization stratified according to the study years and according to the study groups

	usual care				Heart failure center			
	2012 vs. 2013*	P value	2012 vs. 2014**	P value	2012 vs. 2013*	P value	2012 vs. 2014**	P value
Primary care physician visits (mean ± SD)	24.7 ± 16.0 vs. 22.6 ± 14.8	0.001	24.4 ± 15.9 vs. 20.8 ± 13.7	‹ 0.0001	31.0 ± 17.1 vs. 31.8 ± 16.4	0.49	30.3 ± 16.8 vs. 31.2 ± 15.6	0.63
ED visits (mean ± SD)	0.3 ± 0.6 vs. 0.2 ± 0.5	0.11	0.2 ± 0.6 vs. 0.2 ± 0.5	0.26	0.3 ± 0.6 vs. 0.3 ± 0.6	0.68	0.3 ± 0.6 vs. 0.5 ± 1.2	0.18
Number of hospitalizations (mean ± SD)	0.8 ± 1.3 vs. 0.6 ± 1.2	0.07	0.7 ± 1.3 vs. 0.6 ± 1.2	0.74	0.9 ± 13 vs. 1.2 ± 1.5	0.19	0.9 ± 1.3 vs. 1.3 ± 2.1	0.12
Percent hospitalized	38% vs. 34%	0.18	35% vs. 32%	0.40	48% vs. 55%	0.32	48% vs. 51%	0.71

	usual care	Heart failure center	P value
Primary care visits			
Number primary care visits during 2012	26.0 ± 17.3	31.3 ± 17.3	0.005
Number primary care visits during 2013*	22.6 ± 14.8	31.8 ± 16.4	0.0001
Number primary care visits during 2014**	20.8 ± 13.7	31.2 ± 15.6	0.0001
Emergency department visits			
Number of ED visits during 2012	0.3 ± 0.7	0.3 ± 0.6	0.86
Number of ED visits during 2013*	0.2 ± 0.5	0.3 ± 0.6	0.30
Number of ED visits during 2014**	0.2 ± 0.5	0.5 ± 1.2	0.03
Hospitalizations			
Percent of patients hospitalized during 2012	40.4%	47.6%	0.24
Percent of patients hospitalized during 2013*	33.7%	55.5%	0.006
Percent of patients hospitalized during 2014**	32.4%	50.6%	0.04
Number of hospitalizations during 2012	0.9 ± 1.5	0.9 ± 1.3	0.40
Number of hospitalizations during 2013*	0.6 ± 1.2	1.2 ± 1.5	0.003
Number of hospitalizations during 2014*	0.6 ± 1.2	1.3 ± 2.1	0.04

*Excluding patients who died during 2013
**Excluding patients who died during 2013–2014
ED = emergency department, SD = standard deviation

Figure 1. Kaplan–Mayer graph for survival of heart failure patients during the study period

HR 0.19
95%CI 0.0–50.62
P = 0.005
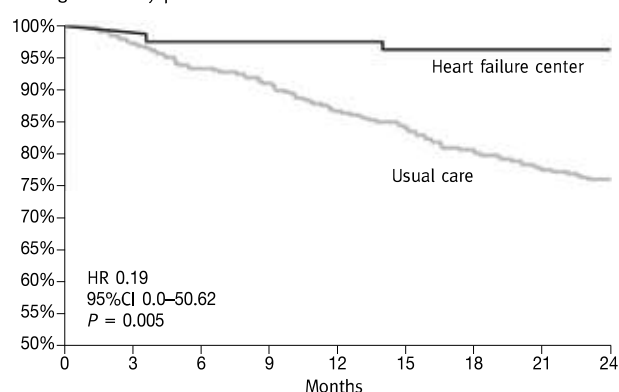
95%CI = 95% confidence interval, HR = hazard ratio

mortality; however, there was a slight increase in the number of short hospitalizations. A partial explanation of the dramatic reduction in mortality in the heart failure center patients can be attributed to the increased prescription of medications that have been shown to have significant beneficial effects in heart failure patients. The educational support of the patients at the center was designed to increase their adherence to treatment and compliance to a healthy lifestyle, which may have also contributed to the improved outcome. Use of medications at the heart failure center was higher than in other reported heart failure patients [8]. While it could be expected that this also would reduce the need for ED visits and hospitalization, this was not seen to be the case in the present study. It is possible that the care and education provided by the center enabled caregivers and/or patients to detect exacerbations at an earlier stage than detected by the general population of heart failure patients, leading to earlier referral to medical attention and hospitalization. Moreover, the location of the heart failure center within a large primary care clinic with ambulatory and hospital care provided by the same heart failure specialists may have had a significant impact on the continuity of care leading to improved outcome. It may have also improved accessibility, especially for patients from low socioeconomic status.

It may be that a complicated cohort of heart failure patients, such as those included in this study, does not receive the adequate care they need [14]. A smooth transition of patient care after discharge from the hospital to the community setting is a challenge and has been shown to have a large impact on re-hospitalization rates [14]. Continuous care of complex heart failure patients is one of the unmet needs that are required to further reduce hospitalization and improve outcome. Thus, the present management program with specialists treating the patient in the community as well as in the hospital could be a major reason for the significantly better outcome at the heart failure center.

LIMITATIONS

This study was observational and not a randomized trial, thus It was not possible to determine why some patients were sent for care at the heart failure center while others were not. It was impossible to exclude selection bias among patients who were referred to the heart failure center. Referrals to the center were primarily for heart failure patients who had been hospitalized, recently deteriorated, or were frequent visitors at the primary care clinic in order to improve care. Therefore, it is unlikely that severe cases or sicker patients were excluded. The similar medication rates in both groups before the study indicate that the groups had similar compliance. Nevertheless, despite the fact that the study groups were not randomized, no substantial differences were seen in the characteristics of the two groups at baseline. Another limitation of the study is that there was insufficient data regarding the severity of the disease among the group of patients in the usual care group, including EF. This omission makes comparisons more difficult, but when comparing the percent of patients in the heart failure center with advanced NYHA class (III–IV), the findings were very similar to other heart failure cohorts in Israel [8]. Charlson Comorbidity Index scores as a proxy for general state were very similar between the groups.

CONCLUSIONS

A community health center dedicated to the management of heart failure patients was associated with improved survival compared to heart failure patients receiving usual care. Close cooperation between the primary care physician and treating cardiologist, as well as the continuous treatment by the same heart failure specialists in the ambulatory and hospital setting, seemed to play a key role in the low mortality rate found in the heart failure center population. The remarkable reduction in mortality was not associated with decrease in use of healthcare facilities. Improved treatment management of chronic patients may improve survival, but not necessarily reduce costs.

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"Fear is a disease that eats away at logic and makes man inhuman"

Marian Anderson (1897–1993), singer

"It is curious that physical courage should be so common in the world, and moral courage so rare"

Mark Twain (1835–1910), American humorist, writer