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Effects of palliative care consultation service on decedents experiencing end-stage heart failure: a 4-year observational study

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Abstract

Background Patients experiencing end-stage heart failure are a particularly important population who carry with them a heavy disease burden. However, evidence related to palliative care for patients with end-stage heart failure remains scarce, particularly when it comes to the issue of palliative care consultation service (PCCS). This 4-year observational study aimed to evaluate the effects of PCCS on opioid use and aggressive treatment during end of life (EOL) among patients diagnosed with end-stage heart failure.

Methods This observational study used the hospice palliative care database of a tertiary medical center in Taiwan. We enrolled all decedents who were diagnosed with end-stage heart failure from the period January 1, 2018 to December 31, 2021. PCCS prior to death was documented with the relationship between PCCS and opioid use and treatment aggressiveness during EOL then analyzed through use of multivariable logistic regression.

Results A total of 120 patients were enrolled, which included 60 (50.0%) patients with end-stage heart failure who received PCCS prior to death. Compared with patients who did not receive PCCS, patients with PCCS during EOL were found to have had significantly more opioids use (odds ratio and 95% confidence interval: 3.192, 1.311–7.768) as well as a greater likelihood of their hospitalization extending for more than 14 days (odds ratio and 95% confidence interval: 4.454, 1.863–10.651) during EOL. Even though patients who received PCCS did not experience significantly different combined treatment aggressiveness during EOL, they received less CPR and had more DNR consent orders. Moreover, the promotion of PCCS increased disease awareness in both patients and their families.

Conclusion PCCS in patients diagnosed with end-stage heart failure during EOL could significantly increase their opioid use and reduce some forms of aggressive treatments during EOL.

Keywords Heart failure, End-of-life, Palliative care consultation service, Aggressiveness

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Introduction

It is well known that we are facing an aging society [1]. Due to advancements in medical interventions and health care, there has been a notable increase in life expectancy worldwide over the recent decades [2]. However, serious life-threatening and life-limiting illnesses still impose a significant social burden and those diagnosed with chronic diseases still experience physical symptoms, as well as both psychological and spiritual problems, even though the overall improvements in medical healthcare have been ongoing [3, 4].

Heart failure (HF) has been considered to be a global pandemic, affecting more than 64 million people worldwide [5]. However, patients with advanced heart failure still suffer from a high burden of distressing symptoms [6, 7], including dyspnea, edema, pain, fatigue, frailty and disability, psychological distress and even a diminished quality of life [8–11]. Even though patients with HF often improve temporarily through intensive diuretic therapy and optimized medical management, there is a notable tendency for symptoms to worsen, resulting in a high hospital readmission rate during advanced stages. Moreover, its high morbidity and mortality rates, which increase with each hospitalization, are quite similar to many types of cancer [12].

Approximately 50% of individuals diagnosed with HF will unfortunately pass away within 5 years [6, 7], with roughly 5% of patients reaching an end-stage of the disease that is refractory to medical therapies [13]. Therefore, it is important to align early on each patient's goals for their care along with the necessary treatment options in order to decrease the inevitable suffering that occurs during the advanced stages of HF.

Palliative care can assist with the alleviation of symptom burden, elucidating and clarifying treatment goals aligned with each patient's values, while also providing psychological support to help improve the quality of life for patients and their families [14, 15]. While palliative care has been traditionally associated with patients diagnosed with cancer, there has been an increasing recognition of its importance in chronic disease management over the recent years [16, 17]. Palliative care has been shown to decrease symptom burden, reduce rates of depression, and enhance quality of life for patients with HF [18, 19].

As for pain and dyspnea during late-stage, opioids can be effective for HF patients as well as for those with cancer [20]. This can often result in a reduction in length of hospital stay, rehospitalization, and the cost of care. Multiple guidelines advocate the early involvement of palliative care for patients with advanced HF [21, 22]. However, palliative care remains widely underutilized in the management of patients with HF [23]. A previous study revealed that patients dying of HF were less likely to receive both opioids and palliative care but were more likely to die in hospitals than patients diagnosed with cancer [24].

Multiple palliative care services have been promoted in Taiwan, including inpatient care in palliative care units [25], palliative home care service [26], and palliative care consultation service (PCCS) [27]. In recent years, PCCS has become the major form of palliative service. In

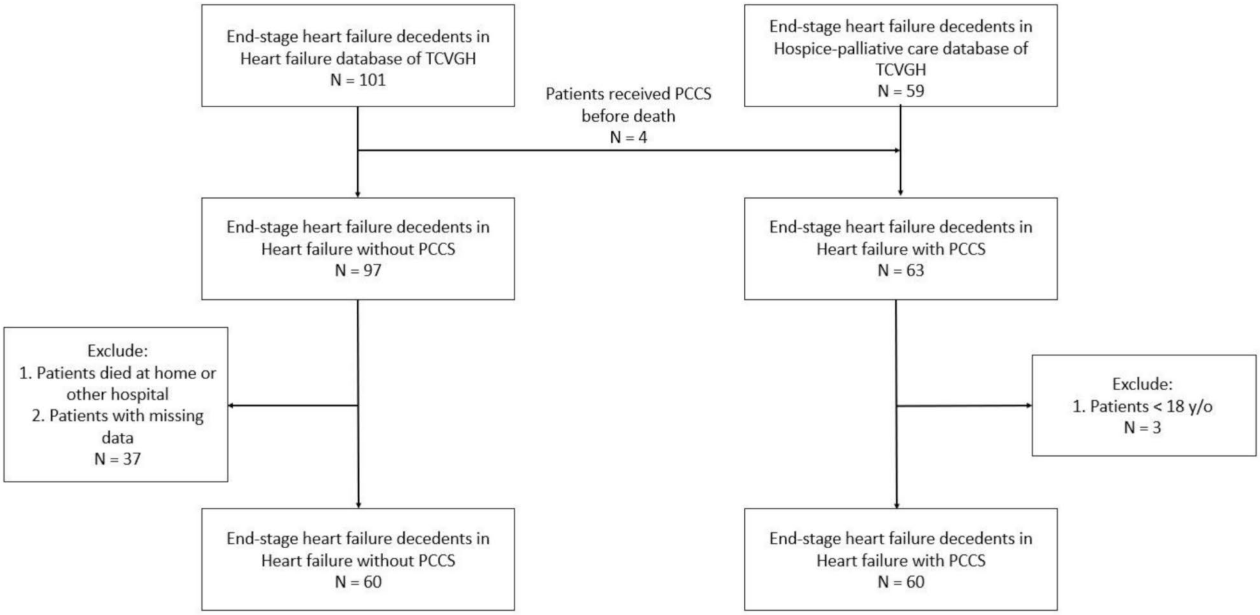

Fig. 1 Flow chart of the study

Taiwan, when patients are admitted to hospital through PCCS, they are cared for in non-hospice wards by the original disease specialist team as well as the palliative care specialist team, which together consist of doctors, nurses, psychologists, social workers and volunteers [28]. A previous study demonstrated that the provision of PCCS during hospitalization for non-cancer patients enhances both patients' and families' understanding of the disease while also promoting greater acceptance of Do Not Resuscitate (DNR) orders [29]. A study in the United States also showed that fewer readmissions and less mechanical ventilation were found when patients received PCCS during admission among HF patients [30]. In 2009, Taiwan's National Health Insurance program extended its coverage of palliative care services to include terminally ill patients with non-cancer conditions. Further advancements in palliative care were driven by amendments to the "Hospice Palliative Care Act" in 2011 and 2013, as well as the implementation of the "Patient Right to Autonomy Act" in 2016 and 2019. These developments significantly improved the accessibility and public recognition of palliative care in Taiwan. By 2021, Taiwan achieved global recognition, ranking third worldwide in the quality of end-of-life care [31].

Previous studies have shown that palliative care can improve symptom control, decrease hospital admissions, reduce healthcare costs and enhance the quality of life for patients with HF; however, similar research remains scarce in Asian populations. Considering the fact that the number of HF patients has been growing quickly in Asia, and given that palliative care development and execution are largely influenced by the policies and cultural views of each country [32], it is important to evaluate the impact of palliative care among the Asian population. In this retrospective observational study, we have aimed to evaluate the effects of PCCS for patients experiencing advanced HF in Taiwan.

Methods

Data sources

The data for this study were sourced from the Hospice-Palliative Clinical Database and the heart failure case management database at Taichung Veterans General Hospital (TCVGH), a prominent public tertiary medical center in central Taiwan with over 1,500 beds. The palliative care team at TCVGH, established in 2003, is composed of a multidisciplinary group of professionals, including physicians, nurses, social workers, consulting psychologists, spiritual counselors, art therapists, and dedicated volunteers. This team provides comprehensive hospice and palliative care services in three settings: inpatient palliative care, Palliative Care Consultation Service (PCCS), and home-based palliative care.

In 2013, TCVGH launched the "Heart Failure Care Team," which focuses on holistic, interdisciplinary care. The team consists of physicians, case managers, specialized nurses, pharmacists, physical therapists, dietitians, and social workers, working collaboratively to deliver comprehensive, cross-disciplinary care and follow-up for heart failure patients. Their shared goal is to ensure personalized discharge planning, regular follow-up calls, referrals to community medical resources, and seamless transitions for continued care and support.

Study group identification

We included all decedents experiencing end-stage heart failure from the period January 1, 2018 to December 31, 2021 who were admitted to Taichung Veterans General Hospital (TCVGH). At TCVGH, all patients diagnosed with heart failure receive individual care and follow-up from the heart failure care team. During hospitalization, the heart failure care team collected comprehensive data from patients, including demographic data, lab reports, medication usage, quality of life and outcome after discharge. Alternatively, some of these patients would additionally receive PCCS care if their attending physician initiates a consultation with the PCCS team. During this process, the palliative care team—comprising both physicians and nurses—visits the patient to thoroughly assess their issues and needs. They document the patient's primary concerns, current illness, ongoing challenges and past treatment experiences, while also engaging in discussions regarding the value of PCCS as well as understanding the preferences of both the patient and their family. Following this comprehensive evaluation, the PCCS team offers recommendations on medication management, physical care, psychosocial support, and any additional care resources to the patient's primary care team. After the initial analysis, a total of 120 patients were enrolled, which included 60 (50.0%) patients with end-stage heart failure who received PCCS before death (Fig. 1).

Independent variables

Data from the enrolled patients were collected and extracted from both the Hospice-Palliative Clinical Database (HPCD) and heart failure case management database, including variables such as age at admission, gender, level of education, primary diagnosis, specialty of the primary care team, Ejection Fraction (EF), date of last admission, date of PCCS enrollment, duration of PCCS service, DNR (Do Not Resuscitate) order status, the individual who signed the DNR order, date of DNR declaration, reason for discharge, patient's outcome, and the date of either discharge or death. For participants receiving PCCS, information surrounding patient and family

Table 1 Baseline characteristics of the participants

Variables	***n* = 120**	
Age	76.04	± 15.81
Gender		
Male	78	65%
Female	42	35%
Education		
Illiterate	15	12.50%
Elementary school	42	35.00%
High school	40	33.33%
College	23	19.17%
Ejection fraction	34.53	± 14.31
Length of stay	29.73	± 53.74
Reason for discharge		
IDD	27	22.50%
Death	74	61.67%
General discharge	19	15.83%
Care specialty		
Other than CV or CVS	51	42.50%
CV or CVS	69	57.50%
Length of HF case management (*n* = 60)	131.11	± 194.7
Length of PCCS (*n* = 60)	48.86	± 136.78
Treatments/ experience during 30 days before death *Pacemaker*		
No	108	90.00%
Yes	12	10.00%
Hemodialysis		
No	65	54.17%
Yes	55	45.83%
Blood transfusion		
No	66	55.00%
Yes	54	45.00%
Nasogastric tube		
No	24	20.00%
Yes	96	80.00%
Total parenteral nutrition		
No	118	98.33%
Yes	2	1.67%
CPR		
No	106	88.33%
Yes	14	11.67%
BIPAP		
No	55	45.83%
Yes	65	54.17%
Endotracheal tube		
No	72	60.00%
Yes	48	40.00%
ECMO		
No	114	95.00%
Yes	6	5.00%
Opioid use		
No	42	35.00%
Yes	78	65.00%
Sedatives		
No	75	62.50%

Table 1 (continued)

Variables	***n*** **= 120**	
Yes	45	37.50%
ICU admission		
No	51	42.50%
Yes	69	57.50%
Emergency admission		
No	17	14.17%
Yes	103	85.83%
Hospitalization for more than 14 days		
No	54	45.00%
Yes	66	55.00%
Hospitalization more than twice		
No	100	83.33%
Yes	20	16.67%
Die in hospital		
No	47	39.17%
Yes	73	60.83%
DNR		
None	14	11.67%
Consent by patient him/herself	20	16.67%
Consent by family members	86	71.67%

IDD, impending death discharge; CV, cardiovascular medicine; CVS, cardiovascular surgery; HF, heart failure; PCCS, palliative care consultation service; CPR, cardiopulmonary resuscitation; BIPAP, Biphasic Positive Airway Pressure; ECMO, Extracorporeal membrane oxygenation; ICU, intensive care unit; DNR, do not resuscitate

awareness of the disease diagnosis and prognosis before and after PCCS was also collected.

The duration of PCCS service was defined as the interval between the date of initial PCCS enrollment, including any consultation by a physician or nurse, and the date of discharge or PCCS termination. Patient and family awareness of the disease was assessed by the PCCS nursing staff assigned to each patient, as well as one family member, both prior to and following PCCS enrollment.

Dependent variables

The outcome variables were aggressive treatments at EOL. The indicators used in this study were adapted from Earle et al. [33], Tang et al. [34] and our previous work on the basis of the data available from the NHI claims database [35]. In this study, we specifically analyzed eight aggressive treatments: more than one Emergency Department (ED) visit within 30 days before death, more than one hospital admission within 30 days before death, a hospital stay longer than 14 days within 30 days before death, ICU admission within 30 days before death, in-hospital death, use of an endotracheal tube (ETT) within 30 days before death, ventilator use within 30 days before death, and the need for CPR within 30 days before death. The Patient Right to Autonomy Act, officially launched in 2019 following its announcement in 2016, emphasizes choices surrounding life-sustaining treatments and artificial nutrition. To better understand the impact of this act on treatment decisions among heart failure patients, we also included blood transfusion (BT) and nasogastric tube (NG) or total parenteral nutrition (TPN) use within 30 days before death as additional treatments. Furthermore, we evaluated the aggressiveness of care at the end of life by examining composite aggressive treatments, utilizing an approach adapted from Chang et al.'s methodology to assess the use of two-treatment combinations [36]. Composite indicators can distill the quality of care into a single, comprehensive value, making them an effective tool for evaluating, ranking, and selecting healthcare providers. This approach offers a valuable alternative to relying solely on multiple individual indicators when assessing performance [37].

Statistical analysis

The total number of participants in this study was 120, and they were divided into two groups based upon whether or not they were enrolled in palliative care. To determine if there were significant differences between patients enrolled in palliative care and those who were not, the study employed both the Wilcoxon test and Chi-square test for analysis. Age and EF were analyzed using the Wilcoxon test, while other variables were analyzed using the Chi-square test. Furthermore, logistic regression was implemented in order to explore the impact of palliative care enrollment on various variables with adjusting multiple confounding factors. Statistical analyses were conducted using SAS version 9.4 (Statistical Analysis Software 9.4, SAS Institute Inc., Cary, NC,

Table 2 Difference in characteristics between end-stage heart failure decedents with PCCS and those without PCCS

Variables	**no PCCS ($n = 60$)**		**PCCS ($n = 60$)**		***P*-value**
Age	73.95	± 14.83	78.13	± 16.59	0.0449
Gender					0.0041
Male	47	78.33%	31	51.67%	
Female	13	21.67%	29	48.33%	
Education					0.8356
Illiterate	7	11.67$%	8	13.33%	
Elementary school	21	35.00%	21	35.00%	
High school	22	36.67%	18	30.00%	
College	10	16.67%	13	21.67%	
Ejection fraction	32.02	± 12.8	37.05	± 15.37	0.085
Length of stay	22.72	± 49.72	36.75	± 57.04	0.1535
Specialty of wards					0.0648
Others	20	33.33%	31	51.67%	
CV or CVS	40	66.67%	29	48.33%	
Treatments/ experience during 30 days before death					
Pacemaker					0.7609
No	55	91.67%	53	88.33%	
Yes	5	8.33%	7	11.67%	
Hemodialysis					0.1427
No	28	46.67%	37	61.67%	
Yes	32	53.33%	23	38.33%	
Blood transfusion					0.582
No	35	58.33%	31	51.67%	
Yes	25	41.67%	29	48.33%	
Nasogastric tube					0.8195
No	13	21.67%	11	18.33%	
Yes	47	78.33%	49	81.67%	
Total parenteral nutrition					0.4958
No	60	100.00%	58	96.67%	
Yes	0	0.00%	2	3.33%	
CPR					0.0105
No	48	80.00%	58	96.67%	
Yes	12	20.00%	2	3.33%	
BIPAP					0.2717
No	24	40.00%	31	51.67%	
Yes	36	60.00%	29	48.33%	
Endotracheal tube					0.1921
No	32	53.33%	40	66.67%	
Yes	28	46.67%	20	33.33%	
ECMO					0.1921
No	32	53.33%	40	66.67%	
Yes	28	46.67%	20	33.33%	
Opioid use					0.0128
No	28	46.67%	14	23.33%	
Yes	32	53.33%	46	76.67%	
Sedatives					1
No	37	61.67%	38	63.33%	
Yes	23	38.33%	22	36.67%	
ICU admission					0.7119
No	24	40.00%	27	45.00%	
Yes	36	60.00%	33	55.00%	
Emergency admission					0.295
No	11	18.33%	6	10.00%	

Table 2 (continued)

Variables	no PCCS ($n = 60$)		PCCS ($n = 60$)		*P*-value
Yes	49	81.67%	54	90.00%	
Hospitalization for more than 14 days					< 0.0001
No	39	65.00%	15	25.00%	
Yes	21	35.00%	45	75.00%	
Hospitalization more than twice					0.2207
No	47	78.33%	53	88.33%	
Yes	13	21.67%	7	11.67%	
Die in hospital					0.7084
No	22	36.67%	25	41.67%	
Yes	38	63.33%	35	58.33%	
DNR					0.0018
No	13	21.67%	1	1.67%	
Yes	47	78.33%	59	98.33%	

IDD, impending death discharge; CV, cardiovascular medicine; CVS, cardiovascular surgery; HF, heart failure; PCCS, palliative care consultation service; CPR, cardiopulmonary resuscitation; BIPAP, Biphasic Positive Airway Pressure; ECMO, Extracorporeal membrane oxygenation; ICU, intensive care unit; DNR, do not resuscitate

USA), with the statistical power set at 80% and a significance threshold set at $P < 0.05$.

Results

Table 1 shows the general characteristics of all participants. The average age was 76.0 years, with a male predominance (65%). Most of the participants completed an elementary school education (35%). For all participants with end-stage heart failure, the average EF was 34.5% and the average length of stay was 29.7 days. For the 60 participants who had received PCCS, the average length of the service was 48.9 days. On the other hand, for the 60 participants without PCCS but who had received regular care through case management, the average length of heart failure case management was 131.1 days.

Table 2 reveals the difference in patient characteristics between end-stage heart failure decedents with PCCS and those without PCCS. Age and gender distribution were found to be statistically different. Compared to participants without PCCS, end-stage heart failure decedents with PCCS were older and more female predominant. Otherwise, there was no statistically significant difference in the length of stay between decedents with PCCS and those without PCCS (PCCS: 36.8 days, no PCCS: 22.7 days, $P = 0.15$). For treatments/experience during the 30 days prior to death, end-stage heart failure decedents with PCCS received less CPR, experienced more opioid use, had a greater likelihood to be hospitalized for more than 14 days, and had more DNR consent orders, all of which were statistically different between the two groups.

Table 3 displays the clinical characteristics of end-stage heart failure decedents with PCCS. Most of the participants were cared for by nonCV/CVS physicians. The majority of reasons for discharge were death (40.0%), referral to a palliative care unit (18.3%) and referral to home care (13.3%). PCCS was able to help improve the patient's understanding of diagnosis from 25.0% prior to PCCS to 37.7% after PCCS. PCCS helped improve the patient's understanding of prognosis from 8.9% prior to PCCS to 26.4% after PCCS. Additionally, PCCS was able to help improve the family member's understanding of prognosis from 55.4% prior to PCCS to 98.1% after PCCS.

Table 4 discloses multivariate logistic regression exploring the effects of PCCS on both medication use and certain aggressive treatments during end of life amongst end-stage heart failure decedents. After adjusting for age, gender, level of education, ejection fraction, specialty of hospital wards and the DNR consent order, when compared with patients who had no PCCS, patients with PCCS during EOL experienced significantly more opioid use (odds ratio and 95% confidence interval: 3.192, 1.311–7.768), as well as a greater chance of hospitalization for more than 14 days (odds ratio and 95% confidence interval: 4.454, 1.863–10.651) during EOL. However, patients with PCCS did not experience any significantly different combined treatment aggressiveness during EOL.

Discussion

In our study, patients with PCCS during EOL experienced significantly greater opioid use. This result is partly consistent with previous studies. Kawaguchi et al. and Nakamura et al. discovered that patients experiencing advanced heart failure showed improvement in symptom relief after the initiation of opioid treatment [38, 39]. Compared to other medical professionals, palliative care teams have greater experience in the utilization of opioids. As a result, patients with PCCS are dispensed more opioids and consequently experience better symptom control and quality of life. However, our study is

Table 3 Characteristics of end-stage heart failure decedents with PCCS

Variables	*n* = 60	
Age	77.6	± 16.69
Gender		
Male	31	51.67%
Female	29	48.33%
Education		
Illiterate	8	13.33%
Elementary school	21	35%
High school	18	30%
College	13	21.67%
Ejection fraction	37.05	± 15.37
Reason for discharge		
Death	24	40.00%
Others	5	8.33%
Transmission to other hospital	3	5.00%
Refer to home care	9	13.33%
Refer to palliative care unit	11	18.33%
IDD	5	8.33%
Discharge	3	5.00%
Care specialty		
Other than CV or CVS	35	58.33%
CV or CVS	25	41.67%
Understanding of diagnosis by patient before PCCS (n = 56)		
No	42	75%
Yes	14	25%
Understanding of prognosis by patient before PCCS (n = 56)		
No	51	91.07%
Yes	5	8.93%
Understanding of prognosis by family before PCCS (n = 56)		
No	25	44.64%
Yes	31	55.36%
Understanding of diagnosis by patient after PCCS (n = 53)		
No	33	62.26%
Yes	20	37.74%
Understanding of prognosis by patient after PCCS (n = 53)		
No	39	73.58%
Yes	14	26.42%
Understanding of prognosis by family after PCCS (n = 53)		
No	1	1.89%
Yes	52	98.11%

IDD, impending death discharge; CV, cardiovascular medicine; CVS, cardiovascular surgery; HF, heart failure; PCCS, palliative care consultation service; CPR, cardiopulmonary resuscitation; BIPAP, Biphasic Positive Airway Pressure; ECMO, Extracorporeal membrane oxygenation; ICU, intensive care unit; DNR, do not resuscitate

Table 4 Multivariate logistic regression exploring the effects of PCCS on medication use and aggressive treatments during end of life among end-stage heart failure decedents

Variables	OR	95% CI	*P* value
Pacemaker	1.579	(0.433,5.765)	0.4893
Hemodialysis	0.667	(0.289,1.538)	0.342
Blood transfusion	1.554	(0.691,3.494)	0.286
Nasogastric tube	1.14	(0.406,3.204)	0.8036
CPR	0.298	(0.055,1.623)	0.1614
BIPAP	0.609	(0.267,1.391)	0.2395
Endotracheal tube	0.857	(0.361,2.033)	0.7254
ECMO	3.05	(0.27,34.438)	0.3672
Opioid use	3.192	(1.311,7.768)	0.0105
Sedatives use	0.945	(0.406,2.2)	0.8964
ICU admission	1.377	(0.563,3.371)	0.4835
ER admission	0.99	(0.271,3.616)	0.9878
Hospitalization for more than 14 days	4.454	(1.863,10.651)	0.0008
Hospitalization more than twice	0.788	(0.248,2.499)	0.6855
Die in hospital	0.955	(0.418,2.183)	0.9138
Aggressiveness 1	-0.201	(-2.720,2.318)	0.8747
Aggressiveness 2	0.14802	(-3.817,4.113)	0.9412

Adjusted for age, gender, level of education, ejection fraction, specialty of primary care team, DNR order

PCCS, palliative care consultation service; CPR, cardiopulmonary resuscitation; BIPAP, Biphasic Positive Airway Pressure; ECMO, Extracorporeal membrane oxygenation; ICU, intensive care unit; ER, emergency room

the first study demonstrating that patients with terminal heart failure receive more morphine use under PCCS care. Future studies are warranted in order to explore the effective collaboration between cardiologists and PCCS teams.

Based upon our results, patients enrolled in PCCS have more chance of hospitalization periods that extend for more than 14 days. This finding was partly consistent with previous studies. Alsalem et al. and Diop et al. discovered that patients who received PCCS were older with more comorbidity, had lengthier hospital stays, higher costs, and higher mortality rates [29, 40]. Palliative care is an interdisciplinary approach aimed at improving the quality of life for both patients and caregivers by providing physical, emotional, psychosocial and spiritual interventions. Therefore, patients and their families are more likely to be referred to a PCCS if they are experiencing a high symptom burden or psychosocial distress at hospital admission [41], which consequently results in longer hospital stays for the patient.

In our study, patients with PCCS did not undergo significantly different levels of treatment aggressiveness during EOL. However, Diop et al. found out that palliative care consultation was associated with fewer readmissions and less mechanical ventilation in the 6 months of follow-up amongst heart failure patients [30]. The reason why our result does not align with the previous study may be due to the fact that the duration from initiation of palliative care consultation to death was too short during our research, averaging only 48.86 days. Davis et al.'s systematic review of randomized trials concluded that palliative care must be provided for at least 3–4 months prior to death in order to reach maximum benefit [42]. This shows the importance of "early palliative care" for non-cancer patients, which was also emphasized in a previous study held in Taiwan [29]. Nevertheless, patients with non-malignant disease still have a shorter duration of palliative care as compared with cancer patients due to the lack of information surrounding the available referral criteria [43, 44]. Recently, there was a referral criteria proposed by Chang et al. [45], however, further efforts should be undertaken to better understand the clinical feasibility of established referral criteria for patients experiencing terminal heart failure.

As one's disease progresses, terminal patients often face many difficult medical decisions. Thus, one of the most crucial aspects of decision making is ensuring that those patients have a comprehensive understanding of their medical condition. From our study, the promotion of PCCS increased disease awareness in both patients and their families. This result was also consistent with previous studies [29]. Awareness of one's terminal illness had a beneficial effect on both harmonious decision making and patient autonomy, while also enhancing the quality of the dying process [46]. Our study demonstrated that PCCS plays a vital role in improving patients' and families' understanding of the disease, which in turn may lead to better management of expectations and care preferences.

Strengths and limitations

This study is the first to be performed in the Asian region which analyzes the effects of PCCS among patients with end-stage heart failure. However, there are several limitations in this study. First, the enrolled population was relatively small. Second, the data was collected from a single tertiary center in central Taiwan, so there may have been selection bias within the participants making the external validity possibly limited. Third, there was no propensity matching within two groups (patients with PCCS and those without PCCS) and laboratory data such as blood tests was lacking. Thus, there may have been some valuable lab data that may not have been included as confounding factors in multivariable analysis.

Implications

Our results show that patients experiencing terminal heart failure received more morphine under PCCS care, and the promotion of PCCS increased disease awareness in both patients and their families. However, the duration from initiation of palliative care consultation to death was too short, and patients with PCCS had not undergone any significantly different treatment aggressiveness during EOL. This reveals the importance of both "early palliative care" and "timely palliative care". Meanwhile, the process of involving PCCS in patients with terminal heart failure should be both re-examined and re-organized, with a particular emphasis being placed on the necessary collaboration between cardiologists and the palliative care team.

Conclusions

This observational study analyzed quality of care during EOL among patients experiencing terminal heart failure, with the results showing that the palliative care consultation service significantly increase opioid use and improve disease awareness in both patients and their families. Establishing a palliative team care model to promote the life quality and spiritual well-being of patients should be considered a major goal in the future of advanced heart failure care.

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Author contributions

W- MC and P- YC contributed to the paper's conceptualization. W- MC, L- SL, C- YC and L- HH contributed to methodology. S- PC contributed to software and validation. S- PC and W- MC contributed to formal analysis. W- MC contributed to investigation. W- MC contributed to resources. L- SL, C- YC and L- HH contributed to data curation. W- MC and P- YC contributed to writing—original draft preparation. J- JW, C- LW, L- CL and P- SH contributed to writing—review and editing. W- MC contributed to supervision and project administration. W- MC is responsible for the overall content as the guarantor. All authors have read and agreed to the published version of the manuscript.

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Data availability

The data that support the findings of this study are available from the authors upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Taichung Veterans General Hospital (Protocol code: TCVGH-IRB CE20362A, Date of approval: December 2, 2020). Consent to participate was waived by the Institutional Review Board Taichung Veterans General Hospital due to the retrospective design of study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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