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Research Article

Characterizing Heart Failure with Reduced Left Ventricular Ejection Fraction Management in Regional Australia

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Abstract

Background: Chronic heart failure (CHF) affects two percent of Australians, with a disproportionate larger prevalence in regional-rural centres. Heart failure with reduced ejection fraction (HFrEF) accounts for over three-quarters of CHF cases. The aim of this study was to characterize the HFrEF population in regional NSW and its management.

Methods: A retrospective study of patients referred for transthoracic echocardiogram (TTE) in the Lower Mid North Coast, NSW from 2013 to 2014. Patients with left ventricular ejection fraction (LVEF) < 55% were subdivided using the New York Heart Association (NYHA) classification. Data collected included symptoms, TTE characteristics and use of anti-failure therapies.

Results: Out of 5332 TTE performed, 982 had a LVEF < 55% (18%). Of the 982 patients, 586 (60%) had an ejection fraction (EF) between 45 - 54%, 231 (23%) between 35 - 44% and 165 (17%) < 35%. Males represented 65% (n = 664/982) of the population. Mean age was 73 years. 20% of patients had symptomatic heart failure (HF). There was a significant positive correlation between symptomatic patients and loop diuretic use (Pearson's $X^2 = 5.32$, df 1, $p = 0.02$). Percentages of patients on treatment were: 15% (82/532) on an angiotensin converting enzyme inhibitor (ACEI)/or angiotensin receptor blocker (ARB); 16% (85/532) on a B-blocker; 47% (248/532) on a B-blocker and ACEI/ARB; and 5% (26/532) on a B-blocker, ACEI/ARB and mineralocorticoid receptor antagonist (MRA). Of 94 patients with an LVEF < 35%, two (2%) used Ivabradine and three (18%) underwent cardiac resynchronization therapy.

Conclusions: HFrEF is commonly identified on TTEs. Medication reviews identified low prescription adherence rates to anti-failure treatment. Further study is needed to understand why current guidelines for CHF management are not adhered to when implementing therapy in this challenging cohort.

Keywords: *Chronic Heart Failure (CHF); Heart Failure with Reduced Ejection Fraction (HFrEF); Transthoracic Echocardiogram (TTE); Left Ventricular Ejection Fraction (LVEF)*

Introduction

Characterizing heart failure with reduced left ventricular ejection fraction management in regional Australia may identify why CHF disproportionately affects more people in the rural setting. CHF affects one in 50 Australians [1] and of those with CHF, half have HFrEF [2]. As a consequence of the higher prevalence rates of HFrEF in regional and rural Australia, there is a higher morbidity, mortality and socio-economic burden related to this disease. These prevalence rates partly reflect the older populations and disproportionately larger Aboriginal communities living in non-metropolitan regions [2-4].

Even after adjusting for age, sex, Aboriginality, individual co-morbidities and socio-economic status, 30 day and one year mortality rates are higher following the index admission [5]. Beyond the increased prevalence rates and demographic factors of persons living with HFrEF in regional and rural Australia, it remains unclear why HFrEF confers a greater morbidity, mortality and socio-economic burden in these regions. One proposed mechanism is due to a lack of adherence to evidence based treatment guidelines. For example, lower prescribing rates for ACEI are found in non-metropolitan regions for HFrEF [4].

However to date, no study has assessed the management of HFrEF in regional and rural Australia. Epidemiological studies have only cited differences in the demographic factors of each population as key to the differences in prevalence rates [2]. Studies remain conflicted regarding whether the prevalence rates reflect disparities in HF management. For example, Clark., et al. [4] argues that CHF patients living in regional Australia have decreased access to GP and CHF management programs. This is in contrast to arguments that increased access to medical therapies for acute coronary syndromes and hypertension increased survivorship and therefore structural heart diseases such as HF [3].

No studies have shown the impact of HF treatment adherence to impact on disease burden. By understanding the patterns of adherence to HFrEF guidelines, strategies can be explored to address the significant burden of disease HFrEF carries. The aim of this study is to characterise whether management of HFrEF in regional and rural Australia comply with evidenced based treatment guidelines.

Methods

Design and participants

This is a retrospective cross-sectional study of all patients referred for TTE to the sole echocardiography service provider in the Lower Mid North Coast, NSW, between 2013 - 2014. Reasons for referral were based on clinical indication including post ischaemic event, surveillance for valvular heart disease and heart failure, assessment for structural abnormalities precipitating arrhythmias and preoperative workup. Data was obtained from the Heart Centre database. Data was collated for each patient including demographic data, reason for referral, symptoms of HF through patient clinical notes and LVEF. There was no previous documentation available regarding treatments and NYHA severity.

Of the patients referred for a TTE, patients with reduced LVEF (< 55%) were included into this study. Patients with reduced LVEF were divided into three groups based on the EF: 45 - 54%, 35 - 44% and < 35%. Arbitrary cut offs were used assuming LVEF > 55% was normal. The cut-off point of 35% was used to reflect medication efficacy studies were based on EF < 35% [6-8].

Prescription adherence to appropriate anti-failure medications was determined based on the ESC guidelines for management of HF.

Outcomes

The distribution of HFrEF subjects across the three categories of EF are described with the proportion of subjects with symptomatic HF. The primary outcome was analysing the proportion of subjects on loop diuretics, ACEI or an ARB, B-blocker, Ivabradine, and the use of cardiac resynchronization therapy in subjects with a LVEF <35% to assess the adequacy of HF management in the Lower Mid Coast.

Statistical analysis

Patient characteristic are reported for each group of HFrEF using descriptive statistics. Categorical data was used to calculate the Pearson $\chi 2$. Two sided $P < 0.05$ was considered statistically significant. Analyses were performed on SPSS Statistics 23.0.0.0.

Results

Of the 5332 patients who had a TTE, 982 patients (18%) had a LVEF < 55%. Sixty-eight percent were male (n = 664/982). The average age was 73 years old (SD 12.8).

LVEF (%)	n (%)	Symptomatic (%)
45 - 54	586 (60)	110 (21)
35 - 44	231 (23)	39 (17)
< 35	165 (17)	35 (22)

Table 1: *Proportion of symptomatic patients stratified by LVEF.*

Overall, 20% (193 out of 961 patients) had symptomatic HF. Of those with symptomatic HF, 21% (n = 119) had an LVEF between 45 - 54%; 17% (n = 39) had an LVEF of 35 - 44%; and 22% (n = 35) had an LVEF < 35%. There was no significant statistical difference in the proportion of patients with symptomatic HF between each group (Pearson's $X^2 = 1.39$, df 2, $p = 0.5$).

Management	n (N = 532)	Percentage (%)
ACEI or ARB	82	15
ACEI and ARB	6	<1
B-blocker	85	16
ACEI or ARB + B-blocker	248	47
ACEI or ARB + B-blocker + MRA	26	5
	n (N = 94)	**Percentage (%)**
Ivabradine	2	2
Cardiac resynchronisation therapy	14	15

Table 2: *Management strategies prescribed amongst HFeEF patients with ivabradine and cardiac resynchronisation indicated only in the LVEF <35% group.*

Medication history was obtained in 532 out of the total 978 patients with HFrEF. Forty-seven percent of patients (n = 248) were on an ACEI or an ARB and a B-blocker. Fifteen and sixteen percent of patients (n = 82 and 85) were on an ACEI/ARB or B-blocker, respectively. Six patients were identified on both an ACEI and an ARB. Five percent of patients (n = 26) were on a combination of an ACEI/ARB, beta-blocker and MRA. Amongst patients with a LVEF of less than 35%, 2 out of 94 (2%) were on Ivabradine. Fifteen percent of patients (n = 14) received cardiac resynchronization therapy.

Of the 193 patients with known signs and symptoms of HF, a medication history was obtained in 94 patients. Forty-three patients (46%) were on a loop diuretic. A larger proportion of patients with symptomatic congestive HF were on a loop diuretic compared to patients, who were asymptomatic (33%; Pearson's $X^2 = 5.32$, df 1, $p = 0.02$). Interestingly, across the different HFrEF subgroups, higher proportions of patients were on loop diuretics as LVEF decreased despite equivalent proportions of patients with symptomatic HF across the subgroups. For example: 27% of patients with an LVEF between 45 - 54% were on Frusemide compared to 61% of patients with an LVEF of less than 35%.

Discussion

The use of TTE in characterising HF is crucial in determining the long term treatment regime to prevent the progression of this disease with the ultimate aim of cardiac remodeling. This clinically translates to a reduction in symptom burden and improved patient quality of life. Timely surveillance is helpful in monitoring treatment effect and further medication adjustments. However during acute decompensation of HF, treatments with loop diuretics should be aimed at symptom control and maintenance of euvolaemic states.

These results highlight three key points regarding HFrEF in regional NSW and its management. They are the use of loop diuretics beyond its indication for symptom control, the importance of medications reviews and low prescribing compliance rates to established HF guidelines.

Use of loop diuretics to manage HFrEF

Of the patients with HFrEF, there was no difference in the proportion of patients reporting signs and/or symptoms of congestive HF between each subgroup. Whilst more symptomatic patients were managed with a loop diuretic compared to asymptomatic patients, a proportion of asymptomatic patients continued to be prescribed loop diuretics. Interestingly, as the degree of LVEF declined, higher proportions of patients were maintained on the loop diuretic. However there was no difference in the proportion of patients with signs and symptoms of HF between each group. Postulated reasons include the failure to optimize other anti-failure medications or its use as a secondary preventer for the development of HF signs and symptoms.

Prescription adherence to established HF guidelines

Management of HF according to established treatment algorithms already poses sufficient challenges as highlighted by the medication adherence rates. Less than half the HFrEF population was on an ACEI/ARB and b-blocker combination. Five percent were on a combination of ACEI/ARB, b-blocker and MRA. Similarly, only 15% of patients with LVEF < 35% had undergone CRT.

It is unclear from this study, however, whether there were any absolute or relative contra-indications precluding the use of the complete range of anti-failure medications. The study was not a cohort study designed to assess patient longitudinally after the initiation or up titration of each class of medication. Therefore it is unknown whether patients subsequently had medications added in subsequent clinical reviews.

Medication reviews

From the medication reviews, the importance of medication reconciliation is raised. Six patients were on both an ACEI and ARB. Dual uses of these agents have no role in HFrEF management due to substantially increased risk of adverse drug events [9]. It is unclear whether these were medication oversight or deliberate use of dual medications to manage HF.

Another issue found in the medication history was the significant time lapse between the TTE examination date and clinician review. Medication changes typically occur in excess of one-month post TTE in clinical practice. One postulated reason is the inadequate access to primary health care, specialist care or community nurse support. One resident cardiologist and one HF specialist nurse practitioner currently service the Lower Mid North Coast. Lack of patient health ownership due to poor education and supports potentially contributed to delays in follow up and ultimately, delayed health care.

It was beyond the scope of the current study to assess patient adherence to their treatment regimes. There is no doubt that achieving treatment goals heavily rely on patient adherence to treatment. Further studies are required to address adherence rates in treatment and to explore barriers to why patients in regional Australia are unable to adhere to prescribed treatment regimes.

Conclusion

In sum, whilst HFrEF currently affects a disproportionately higher proportion of patients in regional Australia studies are required to understand whether low prescription adherence rates to anti-failure treatment initiation was due to patient factors or clinician practice (GP) or both. Studies are also required to examine the impact variations in HFrEF management has on morbidity and mortality rates. With wider research, better understanding and appreciation of HFrEF management in regional Australia can be achieved which will help implement strategies to address the inequality in the disease burden and the significant disparity in CHF service delivery to regional Australia.

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