

# Fibromyalgia has a high prevalence and impact in cardiac failure patients

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## Abstract

**Objective:** Chronic cardiac failure (CCF) shares several clinical features with fibromyalgia (FM), a syndrome of increased central sensitivity and musculoskeletal pain. FM frequently coexists with other chronic illness. Musculoskeletal pain is reported in patients with CCF; however, the prevalence and impact of FM in patients with CCF is not known. This research aims to assess the prevalence and effects of concurrent FM in patients with CCF and to identify other coexisting central sensitivity syndromes.

**Material and Methods:** In a cross-sectional study, demographic, clinical, and functional information was gathered from participants with CCF from public and private clinics. Cardiac failure severity was rated using the New York Heart Association (NYHA) scale. FM diagnosis was determined using 2011 American College of Rheumatology (ACR) criteria. The short-form 36 (SF-36) assessed overall health function.

**Results:** Of the 57 CCF participants (63.2% male, mean age 70.3 years), 22.8% (n=13) met FM diagnostic criteria. CCF patients with FM had poorer outcomes across multiple SF-36 domains ( $p<0.05$ ), compared to those without, despite having comparable CCF severity. Those with FM were more likely to report other central sensitivity syndromes, especially temporomandibular joint dysfunction (mean  $\Delta=23\%$ ,  $p<0.05$ ), headache (mean  $\Delta=28.8\%$ ,  $p<0.05$ ), and irritable bladder (mean  $\Delta=14\%$ ,  $p<0.05$ ).

**Conclusion:** High prevalence of FM was found in patients with CCF. This was associated with increased likelihood of other comorbid central sensitivity syndromes and with poorer clinical outcomes. The recognition of coexisting FM in patients with CCF provides an important opportunity to improve health outcomes by managing FM-related symptoms, in addition to symptoms that relate specifically to CCF.

**Keywords:** Cardiac failure, chronic pain, fibromyalgia, prevalence

## Introduction

Fibromyalgia (FM) is a well-recognized condition that affects approximately 2% to 4% (1, 2) of the population. Patients primarily experience chronic widespread bodily pain, poor quality sleep, significant fatigue, and trouble with concentration and memory.

The pathophysiological mechanisms underpinning FM relate to multiple changes in the way sensory information is processed by the central nervous system, collectively resulting in an increase in central sensitivity levels and "centralized pain" (3, 4). Regional pain problems such as temporomandibular joint disorder, pelvic pain syndrome and irritable bowel, as well as chronic fatigue and chemical sensitivities can all be clinical expressions of increased central sensitivity (4). Physiological and psychological stress are thought to play roles in initiating the development of central sensitivity in genetically susceptible individuals and contribute to worsening symptom severity (5-10). FM occurs in higher rates in patients with chronic disease, including rheumatological illnesses such as rheumatoid arthritis and systemic lupus erythematosus (11). It is also found in higher prevalence coexisting with other chronic disorders including hepatitis B and hepatitis C, thyroid disease, and diabetes (12-15).

Musculoskeletal pain is frequently reported in cardiac failure patients and is linked to reduced quality of life, increased medication, and many symptoms such as fatigue, distress, poor sleep, and depression (16-20). These clinical features are also commonly found in FM; however, there are currently little published data on the prevalence and impact of FM in patients with chronic cardiac failure (CCF). An increased prevalence of FM has been found in patients with coronary artery disease, with a positive correlation between FM severity and a composite score encompassing the number of diseased coronary arteries and left ventricular function at cardiac catheterization (21).



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Given the increased prevalence of FM in many chronic illness populations and the overlap between common features of FM and chronic heart failure, the purpose of this study was to investigate the prevalence and impact of FM in a heart failure population, as well as the presence of other clinical features linked to central sensitivity.

## Material and Methods

From March to November 2014, consecutive patients diagnosed with clinical cardiac failure as determined by a cardiologist according to Framingham criteria attending either a single tertiary public cardiac failure clinic or a single private cardiology practice in Australia were invited to participate (22). Subsequent adult, English-fluent patients providing informed written consent were assessed. Participants answered a questionnaire that gathered demographic, medical history, and medication data, information regarding CCF and FM diagnosis and severity, and a short-form 36 survey (SF-36). Information was also gathered regarding features of other central sensitivity syndromes, including chronic pelvic pain, regional pain syndrome, irritable bladder, irritable bowel syndrome, chronic fatigue, chemical sensitivities, chronic sinus pain, temporomandibular joint dysfunction, restless legs, and headache.

A physical examination to identify tender points was performed. This project was approved by the Institutional Human Research Ethics Committees of the health service and the university where the research was undertaken.

### Assessment tools

Fibromyalgia was diagnosed using the 2011 modification of the 2010 American College of Rheumatology (ACR) Fibromyalgia Diagnostic Criteria (23, 24). The Widespread Pain Index (WPI) and the Symptom Severity score (SS) are the two sub-scores of the 2010 ACR Fibromyalgia Diagnostic Criteria (24). The WPI represents the extent of chronic pain experienced throughout the body and the SS gauges the number and severity of FM symptoms other than pain. The self-administered 2011 modification of the 2010 criteria was developed as a survey instrument in a clinical research setting (referred to here as the 2011 criteria) (23). The sum of the WPI and SS from the 2010/2011 criteria is deemed the "Polysymptomatic Distress Score" (PSD) and can be used to quantify and compare a patient's FM and central sensitivity spectrum severity (25, 26). There are limited data on the prevalence of comorbid FM in patients with other chronic illness using the more recent 2010/2011 criteria. A tender point count was performed on all subjects. Tenderness is a key clinical feature of FM, and the tender point count was included in

the older 1990 ACR Fibromyalgia Classification Criteria (27).

The New York Heart Association (NYHA) functional classification of heart failure has been extensively used over decades as a gauge of heart failure severity, and despite some limitations, is used commonly worldwide (28, 29). This classification scale was used to assess the severity of heart failure experienced by the subjects of this study.

The short-form 36 survey (SF-36) is a 36-question validated survey that assesses eight facets of functionality and health of an individual (30). The SF-36 is a self-administered tool that can be split into two separate domains: overall physical and mental health. Mental and physical health can be further divided to describe vitality, physical functioning, bodily pain, general health, physical role functioning, emotional role functioning, social role functioning, and mental health. Each dimension of the SF-36 is given a score from 1 to 100, with lower scores representing worse outcomes.

### Data analysis

Data entry, processing, and analysis were carried out using Statistical Package for Social Sciences Version 21 (IBM Corp.; Armonk, NY, USA). The analysis was systematic in approach, progressing from frequency tables to t-tests, correlations, and finally multiple/linear regression. Categori-

cal data were used to ascertain prevalence statistics, whereas continuous data were used to delineate means and standard deviations.

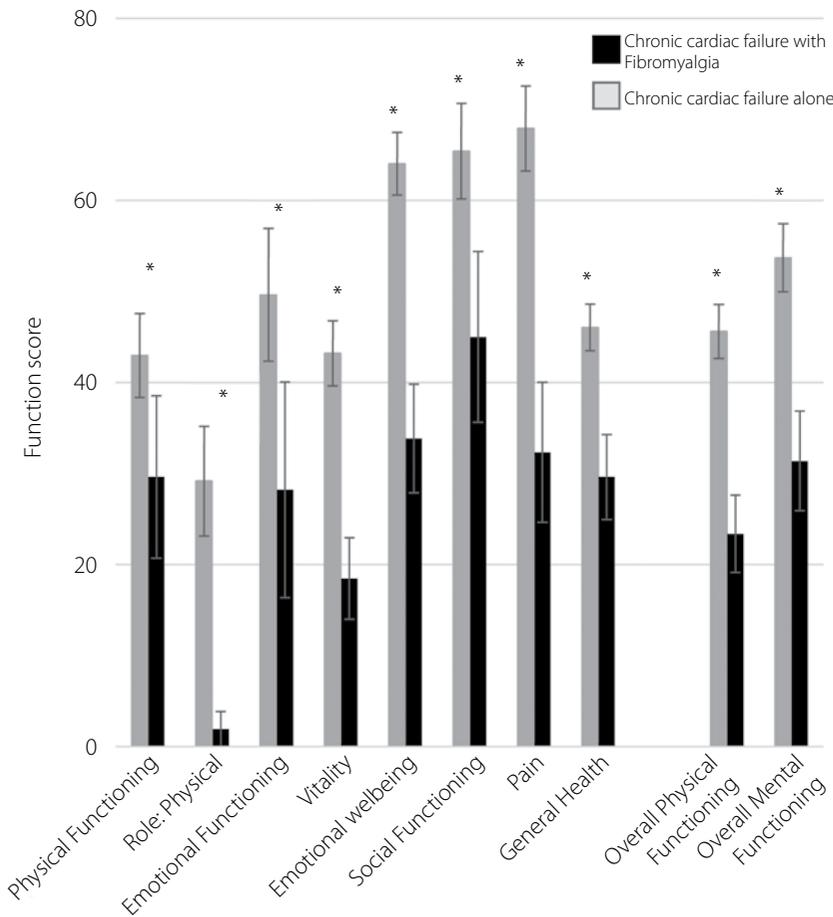
For continuous parametric data, Student's t-test was employed. For non-parametric counterparts, the Mann-Whitney U test was used. One-way Analysis of Variance was utilized in cases of normally distributed data, which was to be compared between the two patient cohorts. In cases of non-parametric data analysis, Kruskal-Wallis one-way analysis of variance was undertaken.  $p < 0.05$  was considered significant.

Pearson's chi-squared test was used for the analysis of the majority of dichotomous data. In cases where analysis was undertaken against small numbers ( $< 5$ ) Fisher's exact test was undertaken. Pearson's product-moment correlations were used to assess relationships between normally distributed continuous variables. Spearman's rank order correlations were undertaken for non-parametric counterparts. All data was checked for homoscedasticity, normality, and linearity. If variables were clinically plausible and highly correlated, standard multiple linear regression was undertaken. All data analyzed with this method was initially checked to meet the assumptions of use: adequate sample size, no outliers, nil multicollinearity, and singularity, in addition to normality (via Shapiro-Wilk test), linearity, homoscedasticity, and independence of residuals.

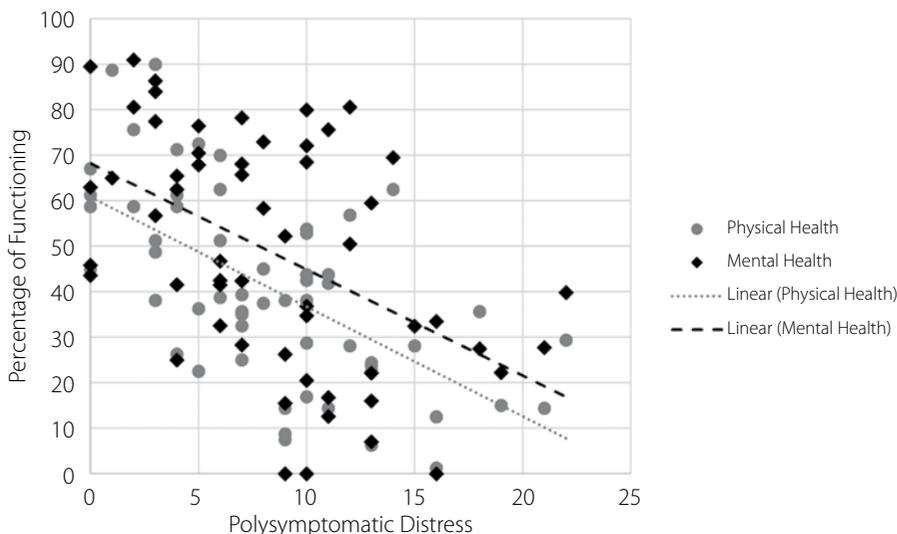
**Table 1.** Demographic data of participants

	Did not meet 2011 ACR FM criteria n=44 (77.2%)	2011 ACR FM criteria met n=13 (22.8%)	p
Age	63.6(±13.6)	60.1(±10.9)	NS
	n (%)	n (%)	
Male	28 (63.6%)	8 (61.5%)	NS
Race			
Caucasian	38 (86.4%)	12 (92.3%)	NS
Asian	4 (9.1%)	1 (7.7%)	NS
Other	2 (4.5%)	0 (0%)	NS
Occupation			
Pension/disability	26 (59.1%)	6 (46.2%)	NS
FT/PT	17 (38.6%)	4 (30.7%)	NS
Other	1 (2.3%)	3 (23.1%)	NS
NYHA			
Class I	8 (18.2%)	1 (7.7%)	NS
Class II	13 (29.5%)	4 (30.8%)	NS
Class III	17 (38.6%)	6 (46.1%)	NS
Class IV	6 (13.6%)	2 (15.4%)	NS

FT: full time; PT: part time, NYHA: new york heart association



**Figure 1.** Participant health outcomes (SF-36 data) in cardiac failure patients who did or did not meet 2011 American College of Rheumatology Fibromyalgia Diagnostic Criteria



**Figure 2.** Overall physical and mental health of all participants (SF-36 data) versus Polysymptomatic Distress Score

**Results**

**Demographics**

Fifty-seven participants were recruited over the study period. Demographic information is presented in Table 1. Participants were predomi-

nantly Caucasian males. About 22.8% (n=13) of CCF patients met the 2011 ACR Fibromyalgia Criteria, 31% of participants were noted to have at least 11 of 18 positive tender points on physical examination, representing significant musculoskeletal tenderness according to 1990 ACR Fibromyalgia Classification Criteria. A total of

19.30% (n=11) participants in the study reported a coexisting diagnosis of depression (23.08% of the group who met FM diagnostic criteria and 18.18% of the group who did not).

**Health outcomes**

Chronic cardiac failure patients who met 2011 ACR Fibromyalgia Criteria reported significantly worse outcomes across all aspects of health as indicated by the SF-36 survey (Figure 1). The difference in social functioning between CCF patients who did not meet FM diagnostic criteria and those who did was particularly marked ( $\Delta=20.4$ ,  $p<0.05$ ). There was also a significant reduction in achievement of role: physical ( $\Delta=27.3$ ,  $p<0.05$ ), general health ( $\Delta=16.4$ ,  $p<0.05$ ), vitality ( $\Delta=24.4$ ,  $p<0.05$ ), and mental health ( $\Delta=22.3$ ,  $p<0.05$ ).

There were significant positive associations between an increase in the PSD score, reflecting increasing central sensitivity, and the participants reported poorer functional outcomes, as measured by the SF-36 in both overall mental and overall physical health (Figure 2).

**Comorbid illness**

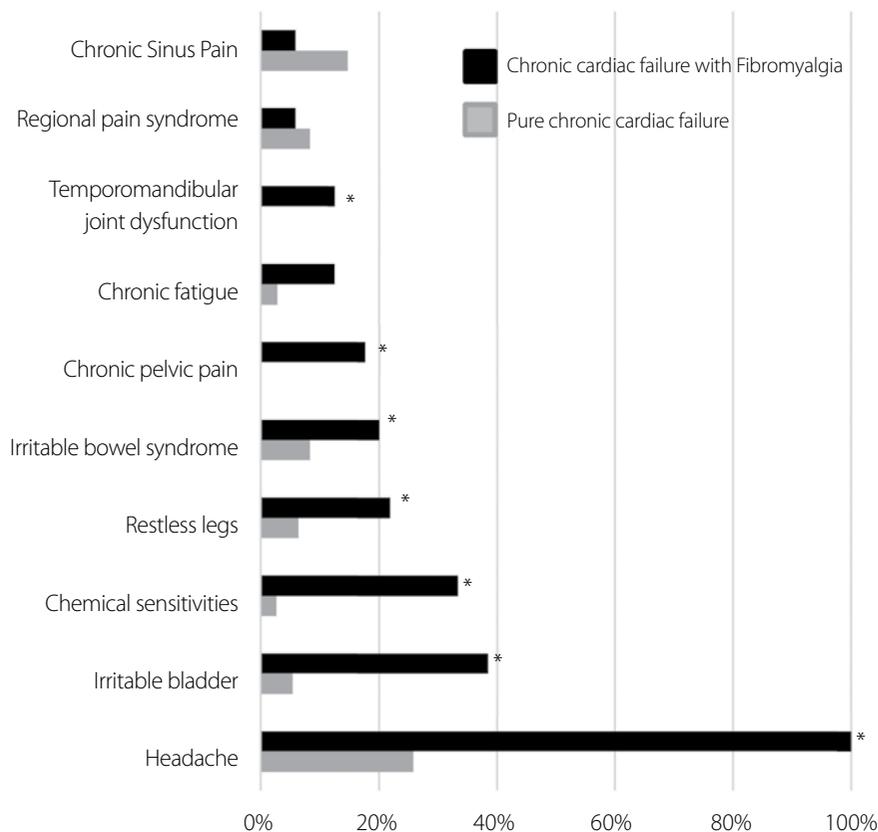
All other central sensitivity syndromes (CSS) were more commonly reported in CCF patients who met criteria for FM. This result reached significance in 7 of the 10 specific CSS asked for in the participant survey (Figure 3).

**Discussion**

The prevalence of FM was high in the CCF cohort with approximately 22% of the studied cohort fulfilling the 2011 ACR Fibromyalgia Diagnostic Criteria. This represents a 10-fold increase on the expected prevalence of FM in this age group (1).

A higher-than-expected proportion of participants with CCF who met the 2011 ACR Fibromyalgia Criteria were men as previous studies usually report a greater prevalence in females (26). This may relate to the overrepresentation of men in the current study group or the small sample size.

The group of patients with a tender point high enough to meet the older ACR 1990 Fibromyalgia Criteria is slightly larger than the group meeting 2011 criteria. This is not in keeping with previous literature, where the 2011 criteria usually capture a larger patient population (31). This might imply that tenderness threshold is lowered in this older population group, compared to the younger patients traditionally studied in pain research. It is noted that similar findings of positive correlation between tenderness and the presence of coronary heart disease in



**Figure 3.** Percentage of participants who reported other central sensitivity syndromes

patients at time of cardiac catheterization has been found (21).

The higher levels of tenderness and musculoskeletal pain in the CCF cohort may also be a clinical manifestation of statin use. Previously, large population studies have conclusively identified the link between chronic muscular pain and statin medication, although information on tenderness is limited (32-35). Of the overall study population, 87.7% (n=50) reported to be currently taking a statin medication. There is therefore scope for this to confound the observed tenderness results. The 2011 criteria used in our analysis may be a more accurate measure of FM in this population.

The prevalence of depression in this study group was in keeping with previously published prevalence of depression in cardiac failure patients, which is reported to range between 11% and 42% depending on variation in investigation methods and heart failure severity (36). There is a recognized bidirectional association between depression and FM which may explain why there was a slightly higher percentage of subjects reporting depression in the group who met FM criteria (37).

Previous work has shown pain, fatigue, and depression all contribute to worse functional performance as measured by the SF-36 in heart

failure patients (19). In this present study, CCF patients with FM had significantly poorer outcomes than their CCF counterparts without FM in all aspects of health. This finding highlights the broad and significant effect FM has on all aspects of well-being and is in keeping with previous SF-36 data comparing FM patients to national norms and other chronic conditions (38-41). These previous studies have, however, been performed in markedly different cohorts and have used the older 1990 criteria for FM classification. Our findings are in keeping with these observed trends and have utilized the 2011 criteria for analysis.

The reduction in the physical health and well-being of the FM cohort may also reflect the comorbidities of this group. The deleterious effects on health suffered from comorbid non-FM CSS may be contributing to the significant differences observed and emphasize the holistic approach to assessment that must be undertaken in this population.

The increase in reporting of other CSS diagnoses in patients with FM, in keeping with previously published literature, highlights the presence of FM as part of an overall picture of increased central sensitivity (42).

The significant reporting of "irritable bladder" in cardiac failure patients, however, may relate

to a misinterpretation of the condition by the CCF cohort. This condition was reported on the basis of symptom survey, which was vulnerable to confounding factors in a patient group of significantly older age, 86% of who reported taking diuretic medication. The CCF cohort also had an overrepresentation of men (60%) with a mean age of around 69 years, thus the likelihood of prostatic hypertrophy is increased in this cohort, possibly further contributing to reports of urinary tract dysfunction.

Despite difficulty caused by the overlap of many symptoms, failure to recognize the proportion of CCF patients that are additionally affected by FM and increased central sensitivity may result in missing a vital aspect of disease burden and lost opportunity for clinical improvement.

Fibromyalgia itself may also impact negatively on cardiac outcomes in CCF patients, as pain stimulates the sympathetic nervous system and increases cardiac workload (43). In summary, FM is a common comorbidity in chronic disease patients, including those with CCF. More than one in five patients with CCF in this investigation met the 2011 ACR Diagnostic Criteria for FM. Patients who met FM criteria also reported a higher prevalence of other features reflecting increased central sensitivity. Overall, patients with CCF who met criteria for concomitant FM had significantly poorer health outcomes across all areas studied.

The recognition and treatment of FM and increased central sensitivity may lead to better clinical outcomes in patients with CCF.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Institutional Human Research Ethics Committees of the health service and the university where the research was undertaken.

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - E.G., G.L.; Design - E.G., G.L.; Supervision - E.G., G.L., A.A.; Resources - E.G., G.L., A.A.; Materials - E.G., G.L.; Data Collection and/or Processing - A.G.; Analysis and/or Interpretation - A.G., E.G., G.L.; Literature Search - A.G., E.G.; Writing Manuscript - A.G., E.G.; Critical Review - E.G., G.L., A.A.

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