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# Factors Associated with Congestive Heart Failure among Patients Presenting with Acute Cardiac Emergencies in Northern Lahore

Kamran Baber, Ammad Javed, Umair Asim, Tahseen Kazmi, Saira Farhat, Shehnaz Khan

**ABSTRACT:**

**Objective:** This study sought to assess the prevalence of congestive heart failure (CHF) and identify the key risk factors associated with its occurrence in patients, already have existing cardiac conditions in Lahore, Pakistan.

**Study Design and setting:** A cross sectional study was conducted at Shalamar Hospital, Lahore.

**Methodology:** The study was conducted from October 2021 to March 2022 on a sample of 891 patients who were admitted in the coronary care unit from the emergency room and OPD and underwent cardiac catheterization. Convenience sampling was employed due to the unavailability of a large pool of patients. The questionnaire utilized socio-demographic variables, assessed the classification of congestive heart failure in relation to various comorbidities including thyroid diseases, diabetes mellitus, hypertension, chronic liver disease, peripheral vascular disease and hyperlipidemia as well as the risk factors associated with CHF.

**Results:** The rate of CHF prevalence was found to be 12.68%. CHF was found to have a statistically significant relationship with smoking, ambulatory ability, and a history of organ transplantation. According to the New York Heart Association, a significant proportion of patients were classified as Class II, whereas the Canadian Cardiovascular Society reported that approximately 42.20% of patients had Class II angina.

**Conclusion:** The prevalence of CHF was discovered to be extremely high. The most common comorbid ailment was discovered as hypertension, followed by diabetes. Many patients reported being able to perform daily activities but becoming fatigued during effort. When changing healthcare policies, it is critical to include preventive measures and interventions.

**Keywords:** Angina Pectoris, Coronary Artery Disease, Coronary Care Units, Congestive Heart Failure

**Kamran Baber**
Consultant Cardiologist, Department of Cardiology
Buch International Hospital, Multan
Email: drkamran.babar@gmail.com

**Ammad Javed**
Resident Physician PGY2, Department of Internal Medicine
MedStar Health Baltimore, USA
Email: ammad.javed@gmail.com

**Umair Asim**
Senior Clinical Fellow, Department of Emergency Medicine
Kings Mill Hospital Nottinghamshire, UK
Email: umair.asim@nhs.net

**Tahseen Kazmi** (*Corresponding Author*)
Professor & Head, Department of Community Medicine
Central Park Medical College, Lahore
Email: tahseenkazmi@gmail.com

**Saira Farhat**
Senior Demonstrator, Department of Community Medicine
Central Park Medical College, Lahore
Email: drsairafarhat@gmail.com

**Shehnaz Khan**
Assistant Professor, Department of Community Medicine
Central Park Medical College, Lahore
Email: shehnaz.atif@gmail.com

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## INTRODUCTION:

Heart failure sometimes also known as congestive heart failure (CHF), is a heterogeneous syndrome defined as a medical condition when the ability of the heart to pump or fill with blood is compromised or it can also be defined as an abnormality of cardiac function that leads to an inappropriate cardiac output leading to inability to meet the metabolic needs of the our bodies. The left ventricular ejection fraction (LVEF) is used to classify CHF. This includes HFrEF (symptomatic HF with LVEF $</= 40\%$), HFmrEF (symptomatic HF with LVEF 41-49%), HFpEF (symptomatic HF with LVEF $>/= 50\%$), and HFimpEF (symptomatic HF with improved LVEF 40%, a $>/= 10$ point increase from baseline LVEF, and a second measurement of LVEF $> 40\%$).[1] Congestive heart failure (CHF) is likely to be a burden on economy and healthcare system of a country. Literature search has shown that CHF is found predominantly in high-income countries also different studies done on epidemiology of disease revealed its disease burden, public health policy formulation and research and healthcare system facility related to CHF. The prevalence of CHF has been increasing in low and middle-income countries due to

the lack of knowledge, lack of sensitivity in understanding presenting symptoms, inappropriate diagnosis and checkups, advancing age and high prevalence of other risk factor such as elevated blood pressure.[2,3] The Global Burden of illness study used modelling approaches to generate comprehensive estimates of illness burden for 204 nations from 1990 to 2020. It has also been declared as emerging epidemic 25 years ago.[4]

In United States (U.S), about 50% of the CHF patients live less than five years from the time of first diagnosis.[5] Burden of heart disease accounts around 60% in South Asia. A recent study reported that South Asians may be at increased risk of heart disease especially young people in most ethnicities.[6] Pakistan is a developing country with limited healthcare resources and facilities. According to a study conducted by Sheikh SA in 2006, the prevalence of congestive heart failure (CHF) in Pakistan is 2.8 million people, despite the fact that no earlier published demographics of this patient population exist. Congestive Heart Failure was more prevalent in males (93%) with an average age of 54 years and ischemic Cardiomyopathy was the most common reason of hospital admissions and outpatient visits for CHF.[7]

According to national surveys, the continual growth in the incidence and prevalence of congestive heart failure (CHF) can be attributed mostly to people aged 70 and up.[8,9] The socio-demographic profile is directly related to the prevalence of congestive heart failure (CHF). Moreover, congestive heart failure (CHF) is an under recognized medical condition which has a huge burden on health care.[10] Quality of life is yet an important parameter to manage the increased risk of CHF.[11]

In Pakistan, there is a dearth of research on congestive heart failure (CHF), including its prevalence, aetiology, and treatment adherence. The current study's goal was to determine the prevalence of congestive heart failure (CHF) and identify risk variables related with its development in patients with proven cardiac illness.

**METHODOLOGY:**

A cross-sectional study was conducted at Shalamar Hospital, Lahore of 6 months duration from October 2021 to March 2022. Data was collected from patients who were admitted to the Coronary Care Unit (CCU) at Shalamar Hospital after visiting the Emergency Room (ER) or Outpatient Department (OPD) and undergoing cardiac catheterization. The minimum sample size calculated by using WHO sample size calculator was 840 by taking 95% confidence interval, 3% absolute precision and 26.9% as prevalence of CHF.[12] The data was collected using non-probability convenient sampling technique. Consecutive critical patients who were registered to get angiography in Shalamar hospital were included in the study.

The study included both males and females between the ages of 18 and 80 who underwent cardiac catheterization

for particular indications according to American College of Cardiology (ACC) guidelines. These operations included angiography, angioplasty with a balloon or a stent, permanent pacemaker installation, peripheral angiography, and angioplasty. Adult patients admitted to the Shalamar Institute's Coronary Care Unit (CCU) with unstable symptoms such as chest pain and dyspnea who were regarded suitable for coronary angiography were also included. Patients with a serum creatinine level greater than 3 mg/dL, those with congenital cardiac anomalies, those with a haemoglobin (Hb) level less than 7 gm/dL, those with blood dyscrasias and a platelet count less than 50,000, and those with an International Normalised Ratio (INR) greater than 2 were excluded from the study.

Clinical examination, chest X-ray, ejection fraction, diastolic metrics, and echocardiography (ECHO) were used to identify CHF patients. They were divided into four classes based on the New York Heart Association (NYHA) classification: Class I (asymptomatic), Class II (normal activities with exertion fatigue), Class III (difficulty in everyday activities), and Class IV (shortness of breath at rest).[13]

The data was collected using a self-designed questionnaire. Data was collected on socio-demographic variables (gender, smoking history, family history of coronary artery disease (CAD), symptoms worsening in the past 6 months, inability to walk), as well as CCS angina class, previous myocardial infarction, steroid usage, past procedures such as (Coronary artery bypass graft (CABG), Percutaneous coronary intervention (PCI), valve replacement), and the presence of various co-morbidities (thyroid disease, diabetes, hypertension, chronic liver disease, ventricular arrhythmia, peripheral vascular disease, organ transplant history, cerebrovascular disease, renal insufficiency, hyperlipidemia)

The Central Park Medical College and Teaching Hospital's institutional review board (IRB) (ERC number: CPMC/IRB-No/1302) approved the study. Prior to data collection, Informed consent was taken from either the patient or their attendant. The data analyst directly entered the questionnaire information into SPSS while ensuring patient confidentiality by using allocated serial numbers rather than personal identities. The chi-square and Fisher's exact tests were used to investigate the link between congenital heart failure and categorical factors. The crude and adjusted odds ratios for defining variables related with congestive heart failure (CHF) were calculated using logistic regression. IBM SPSS version 26 was used for data analysis.

**RESULTS:**

Data was collected from 891 coronary angiography patients, with a mean age of 56.08 11.03 years. Among the participants, 581 (65.20%) were males and 310 (34.80%) were females. The prevalence of congestive heart failure (CHF) was 12.68%. Approximately 423 (47.47%) patients reported worsening of symptoms in the past 6 weeks. Of the total

patients, 632 (70.93%) were able to walk 1 to 2 blocks, and 571 (64.09%) could climb one flight of stairs. Congestive heart failure (CHF) showed statistically significant associations with smoking, ability to walk, and history of organ transplant. Among patients with CHF, the most common comorbidity was malignant ventricular arrhythmia, with a prevalence rate of 88 (77.88%), followed by diabetes with 68 prevalence (60.18%) and hyperlipidemia with 66 prevalence (58.41%) (Table 1).

Binary logistic regression analysis was employed to assess the significance of associated factors and comorbidities that were found to be significant in the association test. The binary logistic model for congestive heart failure (CHF) and its risk factors demonstrated statistical significance according to the Hosmer and Lemeshow test (2 = 14.83, p-value = 0.04). The reference category for all factors was "No". A negative coefficient indicated that the odds of CHF were 0.77 (1-0.23) times higher in patients with a family history of coronary artery disease (CAD). Similarly, malignant ventricular arrhythmia was found to be statistically significant for CHF, with the odds of CHF being 0.98 (1-0.02) times higher in patients with this condition. The factor "ability to walk 1 to 2 blocks" was also significant for CHF. A positive coefficient indicated that patients unable to walk 1 to 2 blocks had 2.82 times higher odds of having CHF (Table 2).

Approximately one-fourth of the patients had a history of previous myocardial infarction (MI), while 8.08% had undergone prior percutaneous coronary intervention (PCI). Only 1.12% of the patients had a history of coronary artery bypass graft (CABG) (Table 3).

No cases of congestive heart failure (CHF) were identified among individuals with chronic liver disease (Figure 1). In the overall population, the prevalence of hypertension was 62.40% (n = 556), with 9.53% (n = 53) of those individuals having congestive heart failure (CHF). Likewise, the prevalence of diabetes was 52.08% (n = 464), with 14.66% (n = 68) of those individuals having CHF (Figure 1). Patients were categorized according to the New York Heart Association (NYHA) classification. Class I represented individuals without symptoms, Class II included patients able to perform normal activities but experiencing exertional fatigue, Class III comprised patients facing difficulties in completing daily activities, and Class IV involved individuals experiencing shortness of breath at rest. The majority of patients fell into Class II, followed by Class III, while the fewest number of patients fell into Class IV (Figure 2a). Furthermore, approximately 42.20% of the patients were categorized as CCS angina Class II (Figure 2b).

**DISCUSSION:**

Our study revealed that the prevalence of congestive heart failure (CHF) among patients who underwent cardiac catheterization in the critical care unit (CCU) was 12.68%.

This rate significantly differs from the findings of another study, which reported an overall prevalence of coronary artery disease (CAD) as the primary outcome. The prevalence of CAD was estimated to be 26.9% (95% CI: 22.3%-32.0%), and it was observed to be higher in women (30%, 95% CI: 23.4%-37.5%) compared to men (23.7%, 95% CI: 17.8%-30.9%), although this difference did not reach statistical significance (p = .20).[12]

The prevalence of congestive heart failure (CHF) was 10.65% among women and 13.77% among men in our study. Surprisingly, our findings did not match the overall prevalence rates of congestive heart failure (CHF), reported as 30.0% in women and 23.7% in men. These results indicated a higher risk of CHF among female patients.[12]

Our study's NYHA classification results revealed that congestive heart failure (CHF) patients were distributed across different classes: Class I (25%), Class II (34.40%), Class III (30.30%), and Class IV (9.70%). Notably, Class II had the highest proportion, while Class IV had the lowest proportion. These findings contrast with another study in which all patients were initially classified as NYHA functional class IV. The predominant cause of congestive heart failure (CHF) in that study was coronary artery disease (CAD), accounting for 73% of cases.[13]

In our study, congestive heart failure (CHF) prevalence among patients admitted to the critical care unit (CCU) from the emergency room (ER) or outpatient department (OPD) undergoing cardiac catheterization was 12.68%. The global prevalence of CHF, based on data from the Global Health Data Exchange registry, was reported as 64.34 million cases. Age was found to significantly impact congestive heart failure (CHF) incidence, with the rate doubling in men for every 10-year increase in age after 65 years.[14] Another study conducted in Pakistan estimated congestive heart failure (CHF) prevalence to be 2.8 million cases.[15]

Our observations revealed that hypertension, malignant ventricular arrhythmia, hyperlipidemia, and renal insufficiency were factors associated with congestive heart failure (CHF). Specifically, hypertension and hyperlipidemia were commonly identified as risk factors among patients with CHF. Previous research has also highlighted hypertension and hyperlipidemia as potential risk factors for cardiovascular diseases (CVDs). Another study reported that myocardial infarction (MI) and coronary artery disease (CAD) were the primary contributors to most CHF cases, with coronary artery disease and diabetes being the predominant risk factors.[17]

The current study revealed a significant association between congestive heart failure (CHF) and a family history of coronary artery disease (CAD) and hypertension (p < 0.05). However, no significant association was found between congestive heart failure (CHF) and diabetes (p = 0.07). Hypertension emerged as the second most prominent risk

Table 1: Correlation of CHF with Socio-Demographic Factors and Comorbidities (n=891)

| Variables | Category | CHF No | CHF Yes | Total | $x^2$ (p-value) |
|---|---|---|---|---|---|
| Gender | Male | 501 | 80 | 581 | 1.78(0.21) |
| | Female | 277 | 33 | 310 | |
| Smoker | No | 523 | 47 | 570 | 28.12 (0.00*) |
| | Yes | 255 | 66 | 321 | |
| Family History of CAD | No | 468 | 34 | 502 | 36.26 (0.00*) |
| | Yes | 310 | 79 | 389 | |
| Able to walk 1 to 2 blocks | No | 187 | 72 | 259 | 75.35 (0.00*) |
| | Yes | 591 | 41 | 632 | |
| Worsening of the symptoms in past 6-weeks | No | 415 | 53 | 468 | 1.64 (0.23) |
| | Yes | 363 | 60 | 423 | |
| History of organ transplant | No | 744 | 58 | 802 | 324.89 (0.00*) |
| | Yes | 06 | 51 | 57 | |
| Chronic Liver Disease | No | 760 | 113 | 873 | 2.67 (0.26) |
| | Mild | 07 | - | 07 | |
| | Moderate | 11 | - | 11 | |
| Malignant Ventricular Arrhythmia | No | 761 | 25 | 786 | 543.77 (0.00)* |
| | Yes | 17 | 88 | 105 | |
| Renal Insufficiency | No | 775 | 54 | 829 | 409.35 (0.00)* |
| | Yes | 03 | 59 | 62 | |
| Thyroid Disease | No | 765 | 60 | 825 | 292.32 (0.00)* |
| | Yes | 13 | 53 | 66 | |
| Diabetes | No | 382 | 45 | 427 | 3.40 (0.07) |
| | Yes | 396 | 68 | 464 | |
| Hypertension | No | 275 | 60 | 335 | 13.25 (0.00)* |
| | Yes | 503 | 53 | 556 | |
| Hyperlipidemia | No | 592 | 47 | 639 | 57.90 (0.00)* |
| | Yes | 186 | 66 | 252 | |
| Peripheral Vascular Disease | No | 778 | 112 | 890 | 6.89 (0.13) |
| | Yes | 0 | 01 | 01 | |
| Total | | 778 | 113 | 891 | |

*p-value <= 0.05 i.e. statistically significant*

Table 2: Binary Logistic Regression for risk factors of CHF (n=891)

| Factors | B | p-value | OR | 95% C. I Lower | 95% C. I Upper |
|---|---|---|---|---|---|
| Smoking | -0.31 | 0.40 | 0.73 | 0.35 | 1.52 |
| Family History of CAD | -0.75 | 0.04* | 0.47 | 0.23 | 0.99 |
| Able to Walk 1 to 2 Blocks | 1.04 | 0.00* | 2.82 | 1.38 | 5.74 |
| Malignant Ventricular Arrythmia | -4.29 | 0.00* | 0.02 | 0.01 | 0.03 |
| Renal Insufficiency | -34.10 | 0.99 | 0.00 | 0.00 | 0.01 |
| Hypertension | -0.51 | 0.20 | 0.60 | 0.27 | 1.32 |
| Hyperlipidemia | -0.44 | 0.26 | 0.65 | 0.30 | 1.39 |

*p-value <= 0.05 i.e. statistically significant*

Table 3: Frequency of selected cardiac risk factors with CHF (n=891)

| Factors | Yes | No | Total |
|---|---|---|---|
| Previous MI | 218 (24.47%) | 673 (75.53%) | 891 (100%) |
| Past CABG | 10 (1.12%) | 881 (98.88%) | 891 (100%) |
| Past valve replacement | 61 (6.85%) | 830 (93.15%) | 891 (100%) |
| Past PCI | 72 (8.08%) | 819 (91.92%) | 891 (100%) |

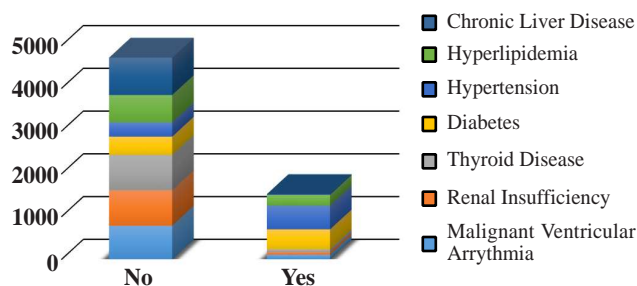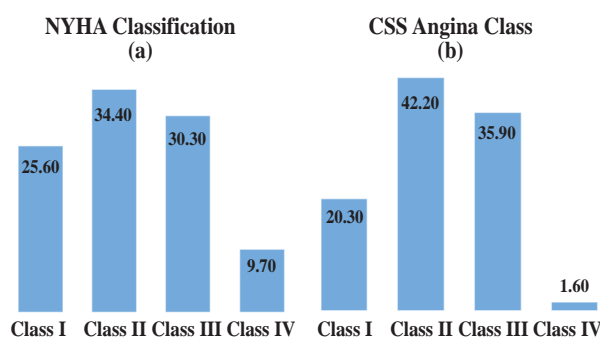Figure 1: Prevalence of CHF across various comorbidities



Figure 2: Distribution of Patients across NYHA Classification (left) and CSS Angina Class (right)



factor for decompensated congestive heart failure (CHF).[18] Common causes of decompensated congestive heart failure (CHF) included inappropriate drug treatment, reduced physical activity, and dietary sodium restriction. Another study conducted in Peshawar, Pakistan, reported diabetes and hypertension as the dominant comorbid conditions, with hypertension alone following closely.[19]

In the current study, NYHA class II was the most common classification (34.4%) seen, followed by class III (30.3%). Similarly, another study reported that 54.9% of congestive heart failure (CHF) patients were categorized as class II, and 31.3% fell into class III.[19] These findings align with another study indicating better outcomes for NYHA class I and class II compared to class III and class IV, potentially due to inadequate self-care and physical activity among patients. Therefore, it is recommended to provide enhanced attention and improved care for patients classified as NYHA class III and class IV.[20] Another observation revealed that approximately 31% of participants fell into NYHA class II

of congestive heart failure (CHF), with 16% classified as NYHA class IV.[21] A recent study discovered that NYHA classes II, III, and IV given social support, and independently influenced self-care confidence showed improvement compared to class I.[22]

## CONCLUSION:

Our study revealed a higher overall prevalence of congestive heart failure (CHF). Hypertension emerged as the most prevalent comorbid condition, followed by diabetes. Family history of coronary artery disease (CAD) was also identified as an associated risk factor for congestive heart failure (CHF). Additionally, a significant proportion of patients had a history of myocardial infarction (MI). According to the New York Heart Association (NYHA) classification, patients falling in class II were able to perform normal activities but experienced exertional fatigue, while others encountered difficulties in completing daily tasks. In order to improve healthcare policies and enhance our understanding of disease epidemiology and risk factors, preventive measures and interventions should be prioritized, and resources should be allocated accordingly.

**Authors Contribution:**
**Kamran Baber:** Conceived idea, literature search, data collection, manuscript writing
**Ammad Javed:** Literature search, data collection, review
**Umair Asim:** Literature search, data collection and methodology
**Tahseen Kazmi:** Statistical analysis and writing of result and discussion, review
**Saira Farhat:** Statistical analysis, methodology and results
**Shehnaz Khan:** Review of manuscript, proof reading and discussion

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