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ORIGINAL ARTICLE

Comparative Study of Systolic and Diastolic Cardiac Failure in Elderly Hospitalized Patients in a Tertiary Care Hospital in Southwest India

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ABSTRACT

Aims:To study and compare the clinical, echocardiographic and the aetiological features of systolic and diastolic cardiac failure in elderly patients.

Methods:This is a prospective observational study done from November 2003 to October 2005. Ninety four patients aged > 60 years who satisfied the Framingham's Criteria for cardiac failure, admitted in the Medicine and Cardiology wards of Kasturba Hospital, Manipal, were included. All patients underwent echocardiographic study and the necessary evaluation to identify the aetiology of the cardiac failure.

Statistical Analysis:The results thus attained, were then charted and analyzed using the SPSS 11.0 statistical software package for Windows. The comparative analysis between Group 1 and Group 2 was done using the Chi-Square test for categorical variables. Continuous variables were also categorized and analyzed using the Chi-Square test.

Results:The mean age of the study group was 68.9 years \pm 6.01 years. It consisted of 57 (60.63%) males and 37 (39.36%) females. Twenty eight (29.78%) patients had isolated systolic failure (Group 1) and 22 (23%) had isolated diastolic failure (Group 2). Tachycardia (p value = 0.017), cardiomegaly (p value = 0.039) and pulmonary rales (p value = 0.003) were more common in Group 1. The most common aetiology in both groups was coronary artery disease (CAD). Hypertension was more common in diastolic failure (p value = 0.010).

Conclusions:This study proves that isolated diastolic failure is a significant presentation among the elderly patients presenting to our hospital. Tachycardia, cardiomegaly and pulmonary rales were more common in systolic failure as compared to diastolic failure. These result from hypertension, which can be easily screened and treated.

Key Messages

- Diastolic failure is a significant presentation in India.
- Tachycardia, Cardiomegaly and Pulmonary rales are less common in diastolic heart failure as compared to systolic failure.
- Untreated hypertension contributes significantly to diastolic heart failure.

Key Words: Congestive cardiac failure, Diastolic heart failure, Elderly, Hypertension, Ischaemic heart disease

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Introduction

Heart failure is one of the commonest conditions that the cardiologist, physician or general practitioner comes across in their practice in hospital care. Recent developments in the management of diabetes, hypertension, dyslipidaemia and coronary artery disease have prolonged survival in clinical conditions resulting from acute cardiovascular events all over the world [1]. Recent research in the field of cardiology has led to the realization that heart failure can occur with preserved systolic function, termed as Diastolic heart failure [2],[3],[4]. Awareness of such a condition and the accurate diagnosis for it is necessary, since the treatment varies from systolic failure and holds a better prognosis [3],[5],[6],[7],[8].

In India, the latest 2001 Census figures show that the age group > 60 years presently constitutes 7.5% of the population (compared to 6.7% of total population in the 1991 census, 6.32% in 1981 and 5.97% in 1971), while the working population between 15-59 years constitutes 56.9% of the population [9]. Life expectancy at birth for India has increased from 48.9 for males and 49.3 for females in 1971, to 61.6 years for males and 62.2 years for females respectively, by 1996 [10],[11].

Methods and Materials

Patients and Settings

This was a prospective observational study conducted over a 2 year period from November 2003 to October 2005. It included 94 elderly patients who were admitted in the medicine and cardiology wards of Kasturba Hospital, Manipal, with a primary diagnosis of cardiac failure. To define the elderly population group, the World Health Organization (WHO) criteria of > 60 years was taken. All patients aged > 60 years who satisfied Framingham's Criteria for cardiac failure after detailed history taking and physical examination, were included in the study. Patients < 60 years who did not satisfy Framingham's criteria and the Echocardiographical criteria for systolic or diastolic dysfunction and with pre-existing lung, renal or liver disease, were excluded from the study. In those patients with recurrent decompensation, only the first admission was included.

Clinical Cardiovascular Assessment

Each patient who was thus presented was assessed clinically using the Framingham's criteria for cardiac failure by the attending physician or cardiologist [12]. Details noted at the time of clinical examination included heart rate, blood pressure, neck vein distension, pedal oedema, presence of additional heart sounds, murmurs, presence of crackles, hepatojugular reflux, hepatomegaly, anaemia, features of renal failure, etc. The clinical features were finalized after agreement between at least 2 of the study authors following independent examinations.

Laboratory and Echocardiographic Evaluation

All subjects underwent a routine battery of investigations including Haemogram, chest radiograph, electrocardiograph, renal function tests and liver function tests. Each and every patient underwent an Echocardiogram within 24 hours of admission using a General Electric

Wingmed System 5 Model 1999 by the same echocardiography technician, to avoid interobserver variation.

Clinical Criteria and Division of Patients

Tachycardia was defined as heart rate with > 120 beats per minute. Cardiomegaly was defined by a radiographic cardiothoracic ratio > 0.55. Radiographs were used to aid in the diagnosis of pleural effusion, cardiomegaly and pulmonary oedema. Hepatomegaly was defined as a liver span > 14 cm. Vital capacity was not measured for any patient as these patients were acutely ill at presentation.

All such patients who satisfied Framingham's criteria with no exclusion criteria were then classified into 3 groups based on Echocardiography findings. Echocardiography parameters utilized were left ventricular internal dimensions, fractional shortening, ejection fraction and Mitral Doppler Flow Velocity ratio (E/A). Patients with Ejection Fraction < 50% and normal Mitral Doppler Flow Velocity E/A (E = Early Left Ventricular Filling Velocity, A = Velocity of Left Ventricular Filling contributed by Atrial Contraction), were considered to have isolated systolic failure, herewith represented as Group 1. Patients with Ejection fraction > 50% with E/A suggestive of diastolic dysfunction, were considered to have isolated diastolic failure, herewith represented as Group 2. Patients with Ejection Fraction < 50% and an E/A ratio suggestive of diastolic dysfunction were the combined failure group, herewith represented as Group 3 [13], [14], [15]. If indicated, Exercise testing, Troponin I, 24 hours Holter monitoring or coronary angiography were carried out to identify the aetiology of cardiac failure. These investigations were carried out with the consent of the patients.

Ischaemic heart disease is defined by the presence of functional ischaemic heart disease (as proven by the Treadmill test, the Dobutamine Stress Echo or the Holter monitoring), > 50% stenosis of at least one coronary artery (by Coronary Angiography), or by the history of angioplasty or Coronary Arterial Bypass Graft (CABG). Patients with previous myocardial infarction or presenting with myocardial infarction have been accounted for separately. Ischaemic dilated cardiomyopathy is defined as the presence of the above criteria for ischaemia or the evidence or history of myocardial infarction with elevated volumes and dilated chambers. Dilated cardiomyopathy describes heart muscle disease in which the predominant abnormality is dilatation of the left ventricle, with or without right ventricular dilatation. Idiopathic dilated cardiomyopathy is a diagnosis of exclusion. Hypertensive cardiomyopathy is diagnosed when myocardial systolic function is depressed out of proportion to the increase in wall stress. A subject presenting with heart failure with hypertensive crisis was thus diagnosed if ventricular dilation and depressed systolic function remained after correction of hypertension [16]. The assessment of the precipitating factors was done on the basis of the same criteria as used in the New York Heart Failure Study [17].

Statistical Analysis

The results thus attained were then charted and analyzed using the SPSS 11.0 statistical software package for Windows. The comparative analysis between Group 1 and Group 2 was done using the Chi-Square test. Categorical variables and continuous variables were also categorized and analyzed by using the Chi-Square test.

Adequate studies on heart failure in India, focusing on diastolic heart failure and the elderly in India, are lacking. Hence, we have taken up this study to shed light on the clinical, echocardiographic and the aetiological features of cardiac failure

among the elderly and to compare the various characteristics between isolated systolic failure and isolated diastolic failure.

Results

General Findings

The mean age of the study group was 68.9 years ± 6.01 years, with 57 (60.63%) males and 37 (39.36%) females. The mean age among males was 69.01 ± 6.485 years and in females, it was 68.76 ± 5.46 years.

The demographic details of the study group and their risk factors are as shown in [Table/Fig 1]. Forty eight (51.06%) were known hypertensives, 40 (42.55%) were known diabetics and 15 (15.95%) were smokers.

(Table/Fig 1) Comparison Of Demographics And Risk Factors Between Group 1 And Group 2

		GROUP 1 n = 28	GROUP 2 n = 22	χ ² VALUE	P VALUE
DEMOGRAPHICS	MEANAGE	69.344±5.62	69.72 ± 5.01	1.085	0.78 (NS)
	61-65	11	6		
	66-70	6	7		
	71-75	9	6		
	75-80	4	3		
	SEX (FEMALE)	9 (31%)	13 (59.1%)		
RISK FACTORS	HYPERTENSION	13 (44.8%)	18 (81.8%)	6.549	0.010 (S)
	DIABETES	10 (34.5%)	8 (36.4%)	0.002	0.962 (NS)

n = number of patients

Out of 94 patients, 28 (29.78%) of patients had isolated systolic failure (Group 1), 22 (23.40%) had isolated diastolic failure (Group 2) and 44 (46.80%) had combined failure (Group 3).

Eighteen (81.8%) patients in Group 2 and only 13 (44.8%) in Group 1 were known hypertensives, which was significant (p value = 0.010). Ten (34.5%) patients in Group 1 and 8 (36.4%) patients in Group 2 were known diabetics, which was not significant (p value = 0.962).

Findings in Cardiac Failure

Among all the 94 elderly patients, the most common symptom was exertional dyspnoea in 84 (89.36%) patients and the most

common clinical sign was pulmonary rales in 78 patients (82.97%). The most common aetiology was coronary artery disease (CAD) in 52 (55.31%) patients, followed by valvular heart disease (VHD) in 12 (12.76%) patients. Ten (10.36%) had idiopathic dilated cardiomyopathy (IDC), 6 (6.38%) had hypertensive cardiomyopathy and 3 (3.19%) patients had both CAD and valvular heart disease. Twenty one (22.34%) of the total 94 patients had a previous history of myocardial infarction and were included under the category of coronary artery disease. The most common valvular heart disease was Aortic stenosis (AS) in 6 patients. Eleven (11.70%) patients had cardiac failure of unknown aetiology.

The most common precipitating factor identified, was severe functional Mitral Regurgitation in 16 (17.02%) patients, while the next most common factor was arrhythmias in 15 (15.97%) of patients. The most common arrhythmias precipitating cardiac failure were atrial fibrillation (AF) and Complete heart block (CHB) in 5 (5%) patients each. Eleven (11.70%) patients had pneumonia and 12 (12.76%) had other sources of infection. Six (6.38%) patients presented with accelerated hypertension and 4 (4.25%) had anaemia. No precipitating cause could be identified in 44 (46.80%) patients.

The comparison of the incidence of signs and symptoms between Group 1 and Group 2 is represented in [Table/Fig 2]. Twenty seven (93%) patients in Group 1 and 13 (59%) patients in Group 2 had pulmonary rales, which was statistically significant (p value = 0.001). Thirteen (45%) patients in Group 1 and 3 (14%) patients in Group 2 had tachycardia, which was statistically significant (p value = 0.014). Nineteen (65.5%) patients in Group 1 and 8 (36.4%) in Group 2 had cardiomegaly, which was statistically significant (p value = 0.027).

(Table/Fig 2) Comparison Of Symptoms And Signs Between Group 1 And Group 2

		GROUP 1 n = 28	GROUP 2 n = 22	χ ² VALUE	P VALUE
SYMPTOMS	DCE	27 (93.1%)	19 (86.4%)	1.723	0.189 (NS)
	NC	9 (31%)	7 (31.8%)	0.001	0.981 (NS)
	PND	13 (44.8%)	6 (27.3%)	1.919	0.166 (NS)
SIGNS	Tachycardia	13 (44.8%)	3 (13.6%)	6.088	0.014 (S)
	HJR	3 (10.3%)	1 (4.5%)	0.673	0.412 (NS)
	NVD	11 (37.9%)	6 (27.3%)	0.792	0.373 (NS)
	Pedal edema	10 (34.5%)	12	1.773	0.183 (NS)
	Cardiomegaly	19 (65.5%)	8 (36.4%)	4.919	0.027 (S)
	S3	12 (41.4%)	4 (18.2%)	3.447	0.063 (NS)
	Pulmonary rales	27 (93.1%)	13 (59.1%)	11.645	0.001 (S)
	Pleural effusion	3 (10.3%)	0 (0%)		
	Pulm. edema	5 (20.7%)	3 (13.6%)	0.517	0.472 (NS)
	Hepatomegaly	5 (17.2%)	5 (22.7%)	0.182	0.670 (NS)

n = Number of patients, DCE = Dyspnoea on exertion, NC = Night Cough, PND = Paroxysmal Nocturnal Dyspnoea, HJR = Hepatojugular Reflux, NVD = Neck Vein Distension, S3 = Third heart sound, Pulm. Oedema = Pulmonary oedema

The comparison of the aetiology between Group 1 and Group 2 is represented in [Table/Fig 3]. One (4%) patient in Group 1 and 8 (36%) patients in Group 2 had valvular heart disease, which was significant (p value = 0.026). Among the 8 patients in Group 2 with Valvular heart disease (VHD), 4 had Aortic stenosis (AS) and 1 had Mitral stenosis (MS) with no proven associated ischaemic aetiology. There were 4 patients in Group 2 who were identified with hypertensive cardiomyopathy, while there were none in Group 1. No aetiology could be identified among 11 (11.70%) of the total number of patients, 9 of which belonged to these 2 groups.

(Table/Fig 3) Comparison Of Etiology In Group 1 And Group 2

ETIOLOGY	GROUP 1 (n = 28)	GROUP 2 (n = 22)	χ ² VALUE	P VALUE
Coronary heart disease	14 (50%)	7 (32%)	2.131	0.144 (NS)
Idiopathic cardiomyopathy	3 (10.7%)	1 (4.5%)	0.673	0.412 (NS)
Valvular heart disease	1 (4%)	8 (36%)	6.158	0.013 (S)
Hypertensive cardiomyopathy	0	4 (18%)		
Coronary heart disease +	2 (7%)	1 (4.5%)		
Unknown	8 (28.57%)	1 (4.5%)		

n = number of patients

Discussion

Studies on diastolic heart failure have been gaining popularity in recent times. Therapeutic research is also in high gear. The reasons for these activities are numerous. They include the increasing proportions of elderly populations in many countries, the confusion regarding clinical criteria to distinguish between the common

systolic failure and the obscure diastolic failure, and finally, the better prognosis attributed to the management of diastolic heart failure. Differentiating between the two forms of cardiac failure becomes even more significant, since the treatment differs between the two conditions, with Digoxin remaining a controversial drug presently in diastolic failure. Despite all this interest on the subject, there are very few studies that have been carried out on this topic in the Indian population. Hence, we have taken up this study to characterize the forms of cardiac failure and to compare their features.

In comparison to other studies carried out on this topic, there is some strength to this study. The clinical assessment of all the patients was done by the same set of clinicians, thus enabling uniformity of assessment. Vasan and Levy have proposed that the diagnosis of diastolic heart failure might be strengthened by shortening the interval between the heart failure event and the documentation of a normal left ventricular ejection fraction [4], [13]. All the echocardiographic and Doppler assessments in these subjects have been carried out within 24 hours of presentation at the hospital. Inter operator variability was minimized by using the same operator to note the echocardiographic findings. The machine used on all the patients was the same, unlike other studies referred here, where patients have been gathered from different centres, clinically assessed by different doctors, and have undergone echocardiographic evaluation by different machines and operators.

The average age of the study group was 68.9 ± 6.01 years and 32% were in the age group of > 70 years. Fifty seven (60.63%) were males. In comparison, The French national survey of heart failure consisted of 73% patients above 70 years of age, with 55% males [21]. The Spanish study at Santiago de Compostela consisted of 40% patients in the age group of > 75 years and 61% were males [22]. Thus, the age profile in this

study was younger, reflecting the relatively younger population of India.

Fifty one percent patients were known hypertensives, which was the most common risk factor, followed by diabetes (42.55%). In the New York Heart Failure Registry, 78% were reported to have hypertension. The ADHERE registry had 70% hypertensives, while the French national survey had 46% known hypertensives and 19% diabetics [23],[24]. Twenty (22.34%) of patients in the present study had a history of previous myocardial infarction. Similar findings were found in the French survey (22%)[21] also.

This study shows that isolated diastolic heart failure (23%) is definitely an important feature in cardiac failure among the elderly patients presenting to our hospital. The incidence of isolated diastolic failure as reported in the ADHERE registry was 46%, that in the Spanish study was 40% and that in the French survey was 38%[21], [22], [24]. This difference can probably be accounted for by the older age profile in these studies, the higher proportion of hypertensive females and the earlier and more severe incidence of coronary artery disease in the Indian population, which has led to a greater proportion of combined failure (Group 3). Even though the comparison of ages between Group 1 and Group 2 did not show any statistically significant difference, isolated diastolic failure does account for a greater proportion of patients in the present study, as age advances. In contrast, both the Spanish and French studies have found significant differences ($p < 0.0001$)[21],[22]. This probably would have been borne out more easily in the present study with larger samples and a higher proportion of patients in the higher age groups. Also, this study did not find any significant difference in the incidence of systolic or diastolic failure among the sexes (p value = 0.057), probably due to lesser proportion of females in the present study and in the higher age groups.

There was no significant difference in the occurrence of various symptoms between the groups. Tachycardia (p value = 0.014), cardiomegaly (p value = 0.027) and pulmonary rales (p value = 0.001) were significantly more common in Group 1. In comparison, the Spanish study found a significantly higher incidence of neck vein distension ($p = 0.030$), third heart sound ($p < 0.0001$), Cardiomegaly ($p = 0.005$) and pulmonary oedema ($p < 0.0001$) in the group with systolic failure [22]. Thus, this study shows that pulmonary rales, tachycardia and cardiomegaly can be used to diagnose systolic cardiac failure with greater certainty.

Coronary artery disease was the most common aetiology of cardiac failure (55.31%). The ADHERE registry had reports of 57% cases and the New York Heart Failure Registry had reports of 43% cases attributed to coronary artery disease[23], [24]. It was the most common aetiology for all three groups. Valvular heart disease (12.76%) was a more common aetiology in isolated diastolic failure (36%) dominated by degenerative valvular disease in the form of Aortic stenosis, the difference being statistically significant (p value = 0.013). Similar findings were stated by the Spanish study (21%).²² In the same study, valvular heart disease was found to be significantly more common in diastolic heart failure (33.1%) than in systolic heart failure (12.6%). Group 2 also had a higher number of hypertensives (p value = 0.010), which was similar to the Spanish (p value < 0.001) and French ($p < 0.05$) study results [21],[22].

Our study has also made an effort to identify the precipitating factors where possible, using similar criteria as reported in the New York Heart Failure Registry [23]. The most common precipitating factor was found to be severe functional Mitral regurgitation ($>$ Grade 3+) (17%), followed by arrhythmias (15.97%).

The findings of this study are shown in comparison to other studies carried out worldwide, albeit, with varying criteria and numbers as shown in [Table/Fig 4].

(Table/Fig 4) Comparison Of Findings With Other Studies

PARAMETER	PRESENT STUDY	ADHERE ²⁰	SPANISH ¹⁹	FRENCH ¹⁸	NEW YORK ¹⁷
Number of patients	94	105388	1252	1058	619
Age	69 ± 6	72.4 ± 14	69.4 ± 12	76 (Median)	71.7 ± 14
% of female patients	39%	52%	38.7%	45%	72.5%
Pulmonary rales	82.97%	NA	76.5%	65%	NA
NVD	31.91%	NA	41.9%	NA	NA
Hepatomegaly	21.27%	NA	23.3%	NA	NA
Third heart sound	30.85%	NA	13.2%	NA	NA
Cardiomegaly	55.93%	NA	79.4%	NA	NA
Pleural Effusion	7.44%	NA	19.4%	NA	NA
Pulmonary edema	21.27%	NA	12.1%	35%	NA
Pedal edema	51.06%	NA	NA	35%	NA
Hypertension	51.06%	73%	55.4%	46%	78.2%
Diabetes	42.55%	44%	26.8%	19%	45.9%
Past MI	22.34%	31%	NA	22%	NA
Smokers	15.95%	NA	31.2%	NA	NA
LVEF	> 50%	> 40%	> 50%	> 40%	> 50%
Normal EF	23.40%	46%	39.8%	38%	ALL
CAD	55.31%	57%	49.2%	NA	43.1%
VHD	12.76%	NA	20.8%	20%	NA

NVD = Neck Vein Distension, LVEF = Left Ventricular Ejection Fraction cut off, EF = Ejection Fraction, CAD = Coronary Artery Disease, Past MI = Past Myocardial Infarction, VHD = Valvular Heart Disease

Limitations of This Study

A larger sample size would have been probably more representative, especially in the higher age groups, since we had only 3 patients above 80 years, all of whom were male. The aim of this study was to study the characteristics between the different types of heart failure and to compare them. This study reflects the findings in patients presenting to this hospital only. Our findings cannot be used to project the incidence and prevalence of the different types of heart failure in the general population or even in the elderly in general. Pro-B type Natriuretic Peptide (Pro BNP) and B type Natriuretic Peptide (BNP) were not available in the hospital at the time of this study.

Conclusions

This study provides evidence that isolated diastolic failure is not an uncommon clinical presentation among the elderly presenting to our hospital. Many result from inadequately treated or undetected hypertension which can be easily screened and treated without the need for invasive, time consuming or

costly investigations. The Indian population is also prone to suffer from coronary artery disease and diabetes at an earlier age as compared to their western counterparts. Early and aggressive recognition and management of these conditions would lead to lesser morbidity and a better quality of life. Hence, we recommend that a strong comprehensive screening program for hypertension, diabetes, dyslipidaemia and coronary artery disease should be implemented.

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