Original Article

Association between Common Etiologies and Precipitants of Acute Decompensated Heart Failure

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Abstract

Background: Acute decompensated heart failure (ADHF) comprises the etiology of heart failure and the precipitant of acute decompensation. Early identification of the precipitant of ADHF is important in management, but an association between the precipitant and etiology of ADHF has not been established. **Objective:** The objective of this study is to determine whether the precipitant of acute decompensation is associated with the etiology of heart failure. **Methods:** This was a prospective observational study conducted over 2 years. Patients with ADHF secondary to common etiologies such as hypertension and rheumatic heart diseases (RHD) were enrolled in the study. The demographics, precipitants, and relevant variables on echocardiography and electrocardiography were documented. The frequencies of the etiology and precipitants of heart failure were derived. The Chi-square test was used to determine an association between categorical variables, and independent *t*-test was used to compare the means of continuous variables. A value of $P < 0.05$ was considered statistically significant. **Results:** There were a total of 190 participants. Hypertensive and RHD were 96 (50.5%) and 94 (49.5%), respectively. One hundred and three (54.2%) were females and males were 87 (45.8%). The precipitants were pneumonia 104 (54.7%), arrhythmias 47 (24.7%), urinary tract infection 36 (19.5%), and infective endocarditis 3 (1.6%). The association between these etiologies and precipitants of ADHF yielded a value of $P = 0.597$. **Conclusion:** There is no association between the precipitant and etiology of ADHF. Therefore, the precipitant of ADHF should be actively sought for in every case for optimal management and better outcomes.

Keywords: Acute decompensated heart failure, etiology, precipitant

Introduction

Acute decompensated heart failure (ADHF) is a sudden or gradual worsening of the symptoms of heart failure in a background of chronic heart failure often requiring hospitalization.[1] It is a common acute heart failure syndrome, and it comprises the etiology of heart failure and the precipitant of acute decompensation. Outcomes post discharges have remained poor despite the recent advances in therapies. The etiology of heart failure is the primary underlying structural heart disease that causes the heart to fail while the precipitant of decompensation is usually an acute illness that causes an exacerbation of heart failure and majority are preventable.[2]

The prevalence of precipitants of ADHF in relation to the etiologies of heart failure has not been widely studied in our locale. The prevalence of the various etiologies of HF has been reported severally.[3,4] Adebayo *et al*.[5] and Sliwa *et al*.[6] reported hypertensive heart disease (HHD) and rheumatic heart diseases (RHD) as the most common causes of HF in our population. The precipitants of ADHF have also been reported; Ogah *et al*.[7] and Fonarow *et al*.[8] documented pneumonia and arrhythmias as the common precipitants of ADHF.

However, none of these studies sought to determine an association between the precipitants and etiology of ADHF. It is, therefore, not established whether the precipitant of ADHF is associated with the etiology of HF. This is the justification for this study. The information from this study will facilitate early identification of precipitants of acute decompensation, which is essential for optimal management of these patients. The hypothesis from preliminary clinical observations is that there is no association between the precipitant of ADHF and the etiology of HF.

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Thus, the purpose of this study is to determine whether the precipitant of ADHF is related to the etiology of HF.

Methods

This was a prospective observational study conducted in a tertiary health center over 24 months. The protocol was approved by the Hospital's Research and Ethics Committee. Patients with ADHF secondary to HHD and RHD were screened for eligibility. Heart failure was defined by Framingham's criteria for the diagnosis of heart failure.[9]

Inclusion criteria

Patients with ADHF secondary to HHD or RHD with an identifiable precipitant were included in the study.

Exclusion criteria

Patients with ADHF secondary to HHD or RHD without an identifiable precipitant were excluded from the study.

Informed consent was obtained from all eligible patients, and they were consecutively enrolled in the study. The age, gender, weight, and height of the patients were recorded. The weights were measured in kilograms on a standard-beam balance unshod, whereas the heights were taken in meters on an anthropometric plane without headgears and shoes. Blood pressure was measured with the standard (Accuson) mercury sphygmomanometer.

Each patient had electrocardiography (ECG) and transthoracic echocardiography done with a Schiller and Philips HD 7 XE machine, respectively. The cardiac dimensions were taken on 2D-guided M mode. The interventricular septum, left ventricular internal diameter , and posterior wall thickness were measured in diastole and systole using the leading edge to leading edge technique. The average of three dimensions was derived and the ejection fraction was determined.

Definition of terms

Hypertensive heart disease

HHD refers to the structural and functional myocardial changes due to long-standing hypertension in the absence of other diseases that could explain these changes. Cases were defined in the presence of left ventricular hypertrophy with or without diastolic or systolic dysfunction, ischemic heart disease, and arrhythmias.

Rheumatic heart disease

RHD is valvular damage (regurgitation and or stenosis) due to previous rheumatic fever. Cases were defined on Doppler echocardiography in the presence of at least two of the following morphologic features; restricted leaflet mobility, focal or generalized valvular thickening, and abnormal subvalvular thickening of the affected valves.

The precipitants of acute decompensation were defined as follows

Pneumonia

Fever, cough, chest signs, and radiological features of pneumonia.

Urinary tract infection

Dysuria and or increased frequency of micturition. Pus cells on microscopy and with or without a positive culture of pathogens.

Atrial fibrillation/arrhythmias

An irregularly irregular pulse. The absence of P waves, irregular. QRS complexes and a fibrillar baseline on ECG.

Infective endocarditis

Infective endocarditis was diagnosed based on the modified Duke's criteria.[10]

Data were analyzed using the Statistical Package for the Social Sciences version 20 (SPSS Inc., Chicago, IL, USA). The means and frequency were derived for continuous and categorical variables, respectively. The association between categorical variables was determined using the Chi-square test, while the independent *t*-test was used to two groups of continuous variables. Value of $P < 0.05$ was considered statistically significant.

Results

There were a total of 190 participants. Ninety-six (50.5%) of the participants had HHD, while 94 (49.5%) had RHD. One hundred and three (54.2%) were females and males were 87 (45.8%). The proportions of the different age groups were as follows: the young 39 (20.5%), middle age 98 (51.6%), and elderly 53 (27.9%). Majority of the elderly 38 (71.7%) had HHD, whereas 35 (89.7%) of the young had RHD. The frequencies of the precipitants are shown in Figure 1. The most common clinically significant arrhythmia was atrial fibrillation (AF) seen in 38 (20%). The others were supraventricular tachycardia 7 (3.6%), and nonsustained ventricular tachycardia 2 (1.0%).

Discussion

This study has shown that there is no significant association ($P = 0.597$) between common etiologies and precipitants of ADHF [Table 1]. This means that none of the precipitants of ADHF is specific for any given etiology of heart failure. Therefore, the precipitant of ADHF cannot be predicted from the etiology of heart failure but it has to be actively sought for in every case for optimal management and better outcomes. There are no known similar studies on this subject with which to compare our results.

The most common precipitant of ADHF was pneumonia 103 (54.2%), as shown in Figure 1. Heart failure patients are vulnerable to chest infections because of elevated pulmonary pressures which results in pulmonary edema during acute decompensation. Pulmonary edema promotes the multiplications of pathogens in the airways. This is particularly so in patients who are not compliant with medications or dietary salt restrictions. Kapoor *et al*.[11] also reported pneumonia and arrhythmias as the two most common precipitants of heart failure. Table 2 shows that the most common precipitant in

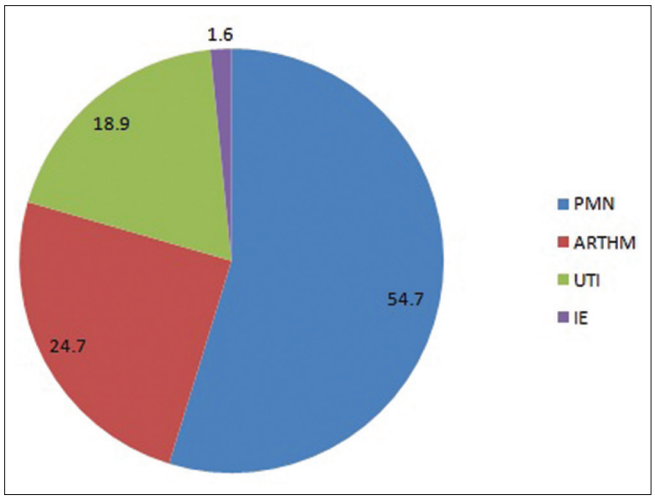

Figure 1: Prevalence of precipitants of acute decompensated heart failure. PMN: Pneumonia, ARTHM: Arrhythmia, UTI: Urinary tract infection, IE: Infective endocarditis

all the age groups was pneumonia. This is expected because over half of the study group had pneumonia.

Arrhythmias were the next most common precipitant of ADHF 47 (24.7%) and AF 39 (81.2%) was the most prevalent arrhythmia (see results). AF has an adverse hemodynamic effect on both systolic and diastolic functions of the heart and it is also a strong risk factor for stroke. Its control is, therefore, a major therapeutic goal in the management of heart failure. Figure 1 shows that 37 (14.2%) of the participants had urinary tract infection and Table 2 shows that it was more common in females 26 (70.3%) as compared to males 11 (29.7%). This is not surprising because the anatomy of the female genital favors the spread of pathogens from the perineum. Figure 1 also shows that infective endocarditis was the least prevalent precipitant of ADHF 3 (1.6%). Better living conditions and ready availability of antibiotics is the most likely reason for the decline in the incidence of infective endocarditis.

Table 3 shows a wide range in the ages of all the participants (24–87 years). RHD is a disease of the young adults, but HHD usually develops later in middle age and beyond. This is corroborated in Table 4 which shows a significantly lower mean age of RHD (46.18 years) compared with HHD (64.02 years). The mean age of the participants with RHD (46.18 years) is similar to that of a study by Ogah *et al*.[12] The likely reason for this is the reported decline in the incidence of RHD in recent years.[12,13] Better living conditions and ready accessibility to antibiotics for the treatment of sore throat could explain this trend.

Table 3 also shows a wide range in the blood pressures of the participants. The study group comprises participants with RHD and HHD whose blood pressures are in the lower and upper end of the range, respectively. Table 4 shows that participants with RHD have a significantly lower blood pressure compared with HHD 108.72 mmHg versus 140.96 mmHg. This is not surprising because patients with RHD usually present late in the course of the disease when cardiac function has become very weak.[14]

Table 1: Prevalence of common precipitants of acute decompensated heart failure in relation to etiology of heart failure

Variable	PMN	ARM	UTI	Total
HHD	54 (56.3)	24 (25.0)	18 (18.8)	96
RHD	50 (54.9)	23 (25.3)	18 (19.8)	91
Total	104	47	36	187

P=0.597, χ^2=1.033, df=2. HHD – Hypertensive heart disease; RHD – Rheumatic heart disease; PMN – Pneumonia; ARM – Arrhythmia; UTI – Urinary tract infection

Table 2: Prevalence of precipitants of acute decompensated heart failure in relation to age and gender

Variable	ARM, *n* (%)	PMN, *n* (%)	UTI, *n* (%)	IE, *n* (%)	Total
Age group (years)					
<40	8 (20.5)	24 (61.5)	4 (10.3)	3 (7.7)	39
40-64	27 (27.6)	54 (55.1)	17 (17.3)	0 (0)	98
65 and above	12 (22.6)	25 (47.2)	16 (30.2)	0 (0)	53
Gender					
Female	26 (25.2)	50 (48.5)	26 (25.2)	1 (0.9)	103
Male	21 (24.1)	53 (60.9)	11 (12.6)	2 (2.3)	87

ADHF – Acute decompensated heart failure; ARM – Arrhythmia; PMN – Pneumonia; UTI – Urinary tract infection; IE – Infective endocarditis

Table 3: Clinical demographic variables of all participants

Variable	Mean±SD	Range
Age (years)	55.37±17.38	24-87
Weight (kg)	63.50±19.75	42-125
Height (m)	1.64±0.09	1.52-1.81
BMI (kg/m^2)	26.1±7.6	18.7-37.8
SBP (mmHg)	124.67±20.81	80-220
DBP (mmHg)	80.34±17.38	50-120
EF (%)	40.22±13.58	18.5-58.6

BMI – Body mass index; SBP – Systolic blood pressure; DBP – Diastolic blood pressure; EF – Ejection fraction; SD – Standard deviation

Table 4: Comparison of demographics of hypertensive and rheumatic heart disease

Variable	HHD	RHD	*P*
Age (years)	64.02±13.43	46.18±16.45	<0.0001
Weight (kg)	71.11±22.88	56.36±13.01	0.002
Height (m)	1.63±0.09	1.63±0.10	0.190
BMI (kg/m^2)	26.1.55±7.46	20.51±6.67	0.508
SBP (mmHg)	140.96±34.95	108.72±25.0	<0.0001
DBP (mmHg)	87.22±23.38	73.38±15.04	<0.0001
EF (%)	45.43±13.20	36.30±10.39	0.014

BMI – Body mass index; SBP – Systolic blood pressure; DBP – Diastolic blood pressure; EF – Ejection fraction; HHD – Hypertensive heart disease; RHD – Rheumatic heart disease

Conclusion

ADHF comprises the etiology of heart failure and the precipitant of acute decompensation, but there is no association between the precipitants and etiology of ADHF. The precipitant should, therefore, be actively sought for in every case for optimal management and better outcomes.

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Conflicts of interest

There are no conflicts of interest.

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