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Evaluation of Impact of Congestive Cardiac Failure on Selected Hematological Markers of Patients in Enugu, Nigeria

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Abstract

Congestive Cardiac Failure (CCF) is a great threat to humanity whenever it occurs. It occurs more often in the elderly and is more in women. It brings about drastic alterations in the entire systems including the haematological system of the human body. Haematological markers are great indicators for health and disease. The study was done to determine the impact of congestive cardiac failure on haematological markers of the patients. The study was done in a Secondary health institution in Enugu. A total of fifty (50) subjects were selected for the study, 25 subjects were congestive cardiac failure subjects aged 74 ± 2.5 years and 25 subjects were apparently healthy individuals aged matched as the control. About 2 ml of venous blood sample was drawn from each subjects into EDTA anticoagulated container and used for the haematological investigations by Mindray BC-5300. The results were presented in tables as mean and standard deviation and analysed using student t-test and level of significance set at $P<0.05$. The results showed significant decrease ($P<0.05$) in ESR, WBC, Neutrophil, MCHC, significant increase ($P<0.05$) in lymphocyte, monocyte, basophil, RBC, haematocrit, MCV, MCH and no significant difference ($P>0.05$) in eosinophils of the congestive cardiac failure subjects compared to the control. The study showed reduced ESR and haemoglobinaemia which may overstress the heart. This condition is dangerous as the red cell line is highly increased as well as the white cell line. This is disastrous if not well managed. The clinicians should monitor the haematological markers especially the haemoglobin and the erythrocyte sedimentation rate in the patients to avert the danger to the patients which will correct when the patient recover from the disease.

Keywords: Congestive cardiac failure; Haematological markers; Enugu

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Introduction

Congestive cardiac failure (CCF) is a multiple clinical syndrome which manifests from any functional or structural heart dysfunction that hinders the ventricle's capacity to fill with or eject blood. Since there is no specific diagnostic test for cardiac failure, it remains a clinical diagnosis that is largely based on a careful history and physical examination and supported by ancillary tests such as chest radiograph, electrocardiogram, and echocardiography. Cardiac failure is a common disease, affecting almost 5 million people in the United States, and it occurs mostly in the elderly, with almost 80% of cases occurring in patients over the age of 65 [1]. The burden of this disease cannot be precisely assessed, because reliable population- based data on the prevalence, incidence, and prognosis are lacking [2].

There are two mechanisms of reduced cardiac output and heart failure: systolic dysfunction and diastolic dysfunction. Diastolic dysfunction can occur in many of the same conditions that lead to systolic dysfunction. The most common causes are hypertension, ischemic heart disease, hypertrophic cardiomyopathy, and restrictive cardiomyopathy [3].

The syndrome of CCF arises as a consequence of an abnormality in cardiac structure, function, rhythm, or conduction. In developed countries, ventricular dysfunction accounts for the

majority of cases and results mainly from myocardial infarction, hypertension, or in many cases both. Degenerative valve disease, idiopathic cardiomyopathy, and alcoholic cardiomyopathy are also major causes of heart failure. Cardiac failure often presents in aging patients who have complex comorbid conditions. Some frequent comorbidities such as kidney dysfunction are multifactorial, whereas others are poorly understood [4]. Congestive cardiac failure indicates not only an inability of the heart to maintain adequate oxygen delivery; it is also a systemic response attempting to compensate for the inadequacy.

Often the effects of chronic CCF are neglected, because the attention is on immediate therapeutic interventions. In stable out-patients with chronic mild CCF, 40% to 50% has obstructive sleep apnea (OSA) and/or Cheyne-Stokes respiration/central sleep apnea (CSR/CSA) [5,6]. Furthermore, CCF patients with CSR/CSA have higher mortality than same-stage CCF patients [7]. Obstructive sleep apnea creates multiple stresses to the cardiovascular system, further exacerbating the failing myocardium. Unlike patients who have primary obstructive sleep apnea but do not have CCF, more than 50% of those who have both CCF and OSA are asymptomatic [8]. Apnea is characterized by a cessation of flow, measured at the nose or mouth, due to central or obstructive events, for 10 seconds. Obstructive sleep apnea is defined as more than 5 of these apnea events per hour. The apneic events lead to an increased negative intrathoracic pressure, from the normal level up to 80 mm Hg [9]. This leads to decreased preload, increased after load, and intraventricular septal shift to the left, with a cumulative effect of further decreasing cardiac output [10]. Hypoxia is another consequence of obstructive events, with a responsive pulmonary vasoconstriction that usually is not sustained during the day; however, repeated episodes can lead to right-ventricular hypertrophy [11].

Haematology has not been particularly useful for the diagnosis of cardiac disease; however, they can be useful to investigate potential concurrent diseases [12]. Much study has not been carried out to determine the impact of congestive cardiac failure on haematological markers in this part of the world. Information regarding this is still scarce as of now regarding the impact of congestive cardiac failure on the haematological markers. This disease has been killing many people especially those who cannot afford hospital bills in developing world like here. This study was done to find out if this disease has any serious impact on the selected haematological markers and the implication to the wellbeing of the patients to improve their lives and to help in better diagnosis of the condition.

Aim

The aim of the study was to evaluate the impact of congestive cardiac failure on selected haematological markers of patients in Enugu, Nigeria.

Materials and Methods

Study area

The study was done in Niger Foundation Hospital, Independence Layout, Enugu, Nigeria.

Study design

The study is a hospital based case study using purposive sampling technique.

Subjects

The subjects comprised of a total of fifty (50) subjects, 25 subjects were patients suffering from congestive cardiac failure and 25 subjects were apparently healthy individuals aged matched as the control.

Ethical consideration

Informed consents were obtained before sample collection and the confidentiality of the results ensured.

Statistical analysis

The results were presented in tables as mean and standard deviation and student t-test used for analysis and the level of significance was set at $P<0.05$.

Haematological Investigation

The haematological investigations were done using Mindray BC-5300.

Results

Table 1 results showed significant decrease ($P<0.05$) in ESR, WBC, Neutrophil, MCHC(1.0 ± 0.1 mm/hr, 5.7 ± 0.5 × 10 × 10^9/L, 61.5% ± 6.2%, 311.0 ± 20.0 g/l) of the congestive cardiac failure subjects compared to the control (9.2 ± 2.1 mm/hr, 6.2 ± 0.3 × 10^9/L, 70.5% ± 5.4%, 330.1 ± 26.7 g/l), significant increase 9 $P<0.05$) in lymphocyte, monocyte, Basophil, Red blood cell, Haemoglobin,, packed cell volume, MCV, MCH of the congestive cardiac failure subjects (30.1% ± 3.8%, 7.7% ± 0.8%, 0.5% ± 0.1%, 6.2 ± 0.4 × 10^{12}/L, 18.8 ± 3.5 g/dl, 60.5% ± 8.0%, 97.0 ± 10.0 fl, 30.1 ± 5.6 pg) compared to the control (27.8% ± 2.1%, 1.5% ± 0.2%, 0.1%

Table 1 Haematological markers of the congestive cardiac failure subjects and the control.

Parameters	CCF	Control	Level of significance
ESR (mm/hr)	1.0 ± 0.1	9.2 ± 2.1	P<0.05
WBC (× 10^9/L)	5.7 ± 0.5	6.2 ± 0.3	P<0.05
Neutrophil (%)	61.5 ± 6.2	70.5 ± 5.4	P<0.05
Lymphocyte (%)	30.1 ± 3.8	27.8 ± 2.1	P<0.05
Monocyte (%)	7.7 ± 0.8	1.5 ± 0.2	P<0.05
Eosinophil (%)	0.2 ± 0.1	0.1 ± 0.1	P>0.05
Basophil (%)	0.5 ± 0.1	0.1 ± 0.1	P<0.05
RBC (× 10^{12}/L)	6.2 ± 0.4	4.9 ± 0.6	4.9 ± 0.6
Haemoglobin (g/dl)	18.8 ± 3.5	14.7 ± 0.2	P<0.05
PCV (%)	60.5 ± 8.0	44.0 ± 5.0	P<0.05
MCV (fl)	97.0 ± 10.0	85.1 ± 12.2	P<0.05
MCV (fl)	30.1 ± 5.6	28.0 ± 4.1	P<0.05
MCHC (g/l)	311.0 ± 20.0	330.1 ± 26.7	330.1 ± 26.7

ESR: Erythrocyte Sedimentation Rate; WBC: Total White Cell Count; RBC: Red Blood Cell; PCV: Packed Cell Volume; MCV: Mean Cell Volume; MCH: Mean Cell Haemoglobin; MCHC: Mean Cell Haemoglobin Concentration; CCF: Congestive Cardiac Failure

± 0.1%, 4.9 ± 0.6 × 10^{12}/L, 14.7 ± 0.2 g/dl, 44.0% ± 5.0%, 85.1 ± 12.2 fl, 28.0 ± 4.1 pg) and no significant difference (P<0.05) in eosinophil.

Discussion

Other methods including clinical, physical examination and radiological methods have been used in the diagnosis of congestive cardiac failure, but haematology has not been adopted as one of the methods.

The study showed decrease in ESR, WBC, Neutrophil, and MCHC and increased lymphocyte, monocyte, basophil, RBC, haemoglobin, packed cell volume; MCV and MCH. The elevated ESR of the congestive cardiac failure subjects shows that their blood may be more viscous and also elevation of haemoglobin which may be dangerous to the health of the patients. The lymphocytes and monocytes that are significantly raised may lead to increase release of cytokines and chemokines which may exacerbate the condition. The increased basophil may elicit hypersensitivity reactions in the patients. The patient needs oxygen perfusion and intensive care. The heart should not be overstressed.

The probable reason for the changes in the haematological variables could be associated to enhanced corticosteroid production or other neurohormonal alterations that occur in heart failure may show elevated leucocyte count as opined by Ristic [13]. This study refutes earlier studies which showed haematology as helpful only in ruling out other diseases [12,14-16]. From this study, it is important that the haematological variables should be monitored because of the level of variations in the haematological markers studied. Heart coordinates the entire human system and has shown to alter the haematological indicators. In a study done using dogs with congestive cardiac failure, the haematological parameters fall within normal range, but anaemia and leucocytosis were observed [17].

The clinicians should pay much attention on the haematological variables as noticed from this study. This could be of diagnostic and therapeutic monitoring system.

Conclusion

The study showed that congestive cardiac failure has serious impact in the haematological markers studied. The whole haematological markers were altered except eosinophil. There was pronounced elevated haemoglobin which could be dangerous to the patients. The ESR was absolutely reduced. The clinicians should monitor the haematological markers in the course of treatment of congestive cardiac failure.

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