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Evaluation of impact of diabetic nephropathy on haematological indices of subjects in Umuahia, Nigeria

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Abstract

Anemia may occur in patients with diabetic nephropathy even before the onset of advanced renal failure. The study was done to determine the haematological indices of Diabetic Nephropathy subjects in Umuahia, South East, Nigeria. The study was done in a Secondary Health Facility. The study is a hospital based prospective cross sectional study using purposive sampling technique from January, 2016 to August, 2017. A total of hundred subjects were recruited for the study. Fifty subjects aged 30- 65 years who were diagnosed of diabetic nephropathy in the hospital were selected for the study and the fifty subjects who were apparently healthy aged matched were chosen as the control. 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 $P < 0.05$. The haematological investigations were done using Mindray BC-5300. The results showed significant decrease ($P < 0.05$) in neutrophil, red blood cell haemoglobin, packed cell volume and mean cell haemoglobin concentration of the diabetic nephropathy (DN) subjects ($49.0 \pm 2.6\%$, $3.93 \pm 0.2 \times 10^{12}/L$, $11.8 \pm 0.7 g/dl$, $40.0 \pm 2.3\%$, $289.0 \pm 6.2 g/dl$) compared to the control ($62.0 \pm 4.7\%$, $5.11 \pm 0.6 \times 10^{12}/L$, $15.3 \pm 1.4 g/dl$, $46.0 \pm 1.5\%$, $332.6 \pm 10.2 g/dl$), significant increase ($P < 0.05$) in lymphocyte, monocytes, eosinophil, mean cell volume, and platelet of the diabetic nephropathy (DN) subjects ($44.0 \pm 5.1\%$, $5.0 \pm 0.9\%$, $2.0 \pm 0.1\%$, $101.8 \pm 4.1 fl$, $358.0 \pm 7.8 \times 10^9/L$) compared to the control ($35.8 \pm 7.8\%$, $2.0 \pm 0.5\%$, $0.2 \pm 0.1\%$, $90.0 \pm 3.6 fl$, $269.0 \pm 12.4 \times 10^9/L$) and no significant difference ($P > 0.05$) in ESR, WBC and MCH of the diabetic nephropathy (DN) subjects ($10.0 \pm 0.6 mm/hr$, $5.2 \pm 0.8 \times 10^9/L$, $30.0 \pm 1.2 pg$) compared to the control ($9.2 \pm 0.4 mm/hr$, $5.0 \pm 0.5 \times 10^9/L$, $29.9 \pm 0.4 pg$) respectively. The study showed decrease in red cell lines and increase in lymphocytes, monocytes and eosinophil could stimulate increase release of inflammatory cytokines. The anaemia observed here was mild maybe linked the degree of damage to kidney. Diabetic nephropathy patients should be monitored for anaemia and some cytokines that may affect the prognosis of the treatments. It will be necessary to monitor their diets and ensure their sugar level is under control.

Keywords: Diabetic Nephropathy, Haematological Indices, Umuahia

Introduction

Diabetic nephropathy is reported as the leading cause of chronic kidney disease in patients starting renal replacement therapy and has been linked to increased cardiovascular mortality [1]. Diabetic nephropathy has been classically defined by the presence of proteinuria >0.5 g/24 h. This stage has been referred to as overt nephropathy, clinical nephropathy, proteinuria, or macroalbuminuria. In the early 1980s, seminal studies from Europe revealed that small amounts of albumin in the urine, not usually detected by conventional methods, were predictive of the later development of proteinuria in type 1 and type 2 diabetic patients [2].

Diabetic nephropathy is reported to develop in, at most, 40% of patients with diabetes, even when high glucose levels are maintained for long periods of time. This observation raised the concept that a subset of patients has an increased susceptibility to diabetic nephropathy. Furthermore, epidemiological [3] and familial studies [4,5] have demonstrated that genetic susceptibility contributes to the development of diabetic nephropathy in patients with both type 1 and type 2 diabetes. The main potentially modifiable diabetic nephropathy initiation and progression factors in susceptible individuals are sustained hyperglycemia [6] and hypertension [7]. Other putative risk factors are glomerular hyperfiltration [8], smoking [9], dyslipidemia [10,11], proteinuria levels, and dietary factors, such as the amount and source of protein [12] and fat in the diet [13].

Anemia may occur in patients with diabetic nephropathy even before the onset of advanced renal failure, and it has been linked to erythropoietin deficiency [14]. Furthermore, anemia has been considered a risk factor for progression of renal disease and retinopathy. It is recommended to start erythropoietin treatment when haemoglobin levels are <11 g/dl. The target haemoglobin levels should be 12–13 g/dl, and the potential risk of elevation of blood pressure levels with erythropoietin treatment should be taken into account [15].

Aim

The aim of the study was to determine the haematological indices of Diabetic Nephropathy subjects in Umuahia, South East, Nigeria.

Materials and Methods

Study area

The study was done in Daughters of Mary Mother of Mercy Hospital Umuahia, Abia State, Nigeria.

Subjects

A total of hundred subjects were recruited for the study. Fifty subjected aged 30–65 years who were diagnosed of diabetic nephropathy in the hospital were selected for the study and the fifty subjects who were apparently healthy aged matched were chosen as the control.

Study design

The study is a hospital based prospective cross sectional study using purposive sampling technique from January, 2016 to August, 2017.

Ethical consideration

This study was performed in compliance with the guidelines of the Helsinki Declaration on biomedical research on human subjects. It was a prospective study, and confidentiality of the identity of the patients and personal health information was maintained.

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. The haematological parameters investigated include Erythrocyte Sedimentation Rate (ESR) total white blood cells (WBC), neutrophils, lymphocytes, red blood cells, haemoglobin, packed cell volume (PCV), mean cell volume (MCV), mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC).

Results

The results showed significant decrease ($P<0.05$) in neutrophil, red blood cell haemoglobin, packed cell volume and mean cell haemoglobin concentration of the diabetic nephropathy (DN) subjects ($49.0\pm2.6\%$, $3.93\pm0.2 \times 10^{12}/L$, $11.8\pm0.7g/dl$, $40.0\pm2.3\%$, $289.0\pm6.2g/dl$) compared to the control ($62.0\pm4.7\%$, $5.11\pm0.6 \times 10^{12}/L$, $15.3\pm1.4 g/dl$, $46.0\pm1.5\%$, $332.6\pm10.2g/dl$), significant increase ($P<0.05$) in lymphocyte, monocytes, eosinophil, mean cell

volume, and platelet of the diabetic nephropathy (DN) subjects ($44.0\pm5.1\%$, $5.0\pm0.9\%$, $2.0\pm0.1\%$, $101.8\pm4.1fl$, $358.0\pm7.8 \times 10^9/L$) compared to the control ($35.8\pm7.8\%$, $2.0\pm0.5\%$, $0.2\pm0.1\%$, $90.0\pm3.6fl$, $269.0\pm12.4 \times 10^9/L$) and no significant difference ($P>0.05$) in ESR, WBC and MCH of the diabetic nephropathy (DN) subjects ($10.0\pm0.6mm/hr$, $5.2\pm0.8 \times 10^9/L$, $30.0\pm1.2pg$) compared to the control ($9.2\pm0.4mm/hr$, $5.0\pm0.5 \times 10^9/L$, $29.9\pm0.4pg$) respectively.

Table 1: showing haematological parameters of non- Hodgkin Lymphoma (NHL) subjects and the control

Parameters	DN(50)	Control(50)	Level of Significance
ESR(mm/hr)	10.0 ± 0.6	9.2 ± 0.4	$P>0.05$
WBC ($\times 10^9/L$)	5.2 ± 0.8	5.0 ± 0.5	$P>0.05$
Neutrophil (%)	49.0 ± 2.6	62.0 ± 4.7	$P<0.05$
Lymphocyte (%)	44.0 ± 5.1	35.8 ± 7.6	$P<0.05$
Monocyte (%)	5.0 ± 0.9	2.0 ± 0.5	$P<0.05$
Eosinphil (%)	2.0 ± 0.1	0.2 ± 0.1	$P<0.05$
RBC ($\times 10^{12}/L$)	3.93 ± 0.2	5.11 ± 0.6	$P<0.05$
Haemoglobin (g/dl)	11.8 ± 0.7	15.3 ± 1.4	$P<0.05$
PCV (%)	40.0 ± 2.3	46.0 ± 1.5	$P<0.05$
MCV (fl)	101.8 ± 4.1	90.0 ± 3.6	$P<0.05$
MCH (pg)	30.0 ± 1.2	29.9 ± 0.4	$P>0.05$
MCHC (g/l)	289.0 ± 6.2	332.6 ± 10.2	$P<0.05$
Platelets ($\times 10^9/L$)	358.0 ± 7.8	269.0 ± 12.4	$P<0.05$

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, DN= Diabetic nephropathy subjects

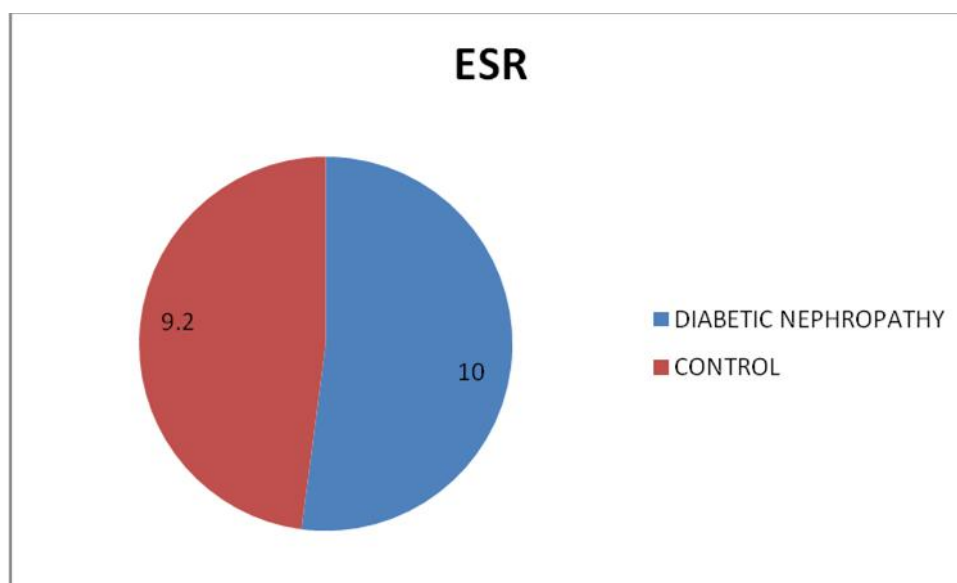


Fig 1:ESR of Diabetic Nephropathy subjects and control

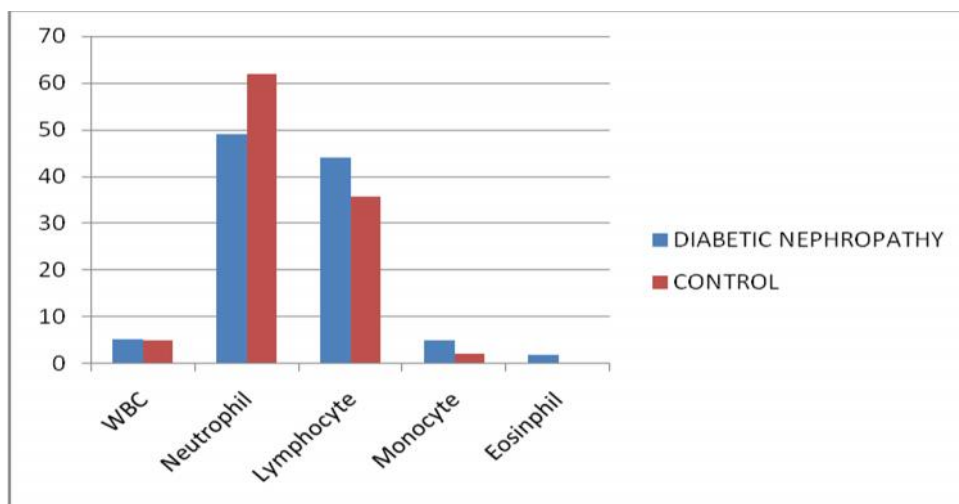


Fig 2: WBC, Neutrophil, Lymphocyte, Monocyte, Eosinophil of Diabetic Nephropathy subjects and control

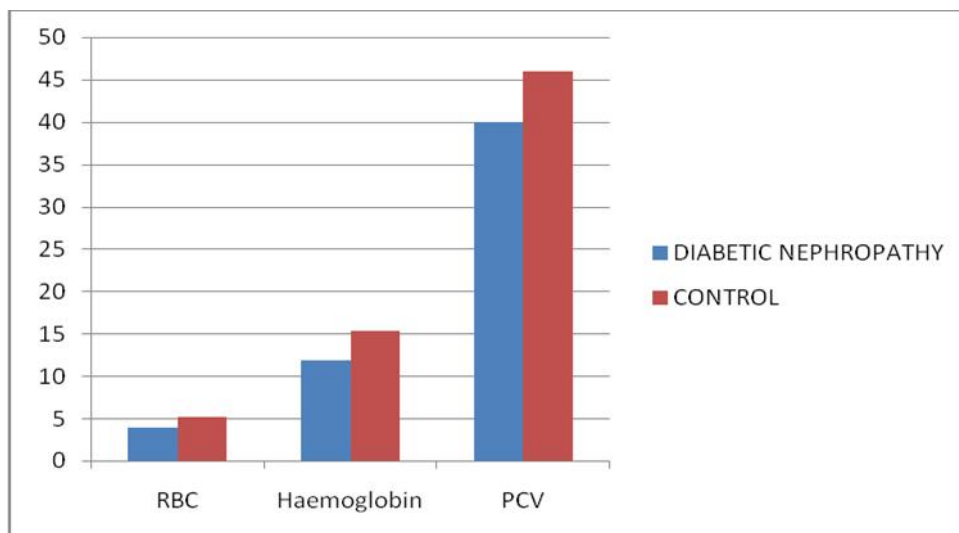


Fig 3: RBC, Haemoglobin PCV of Diabetic Nephropathy subjects and control

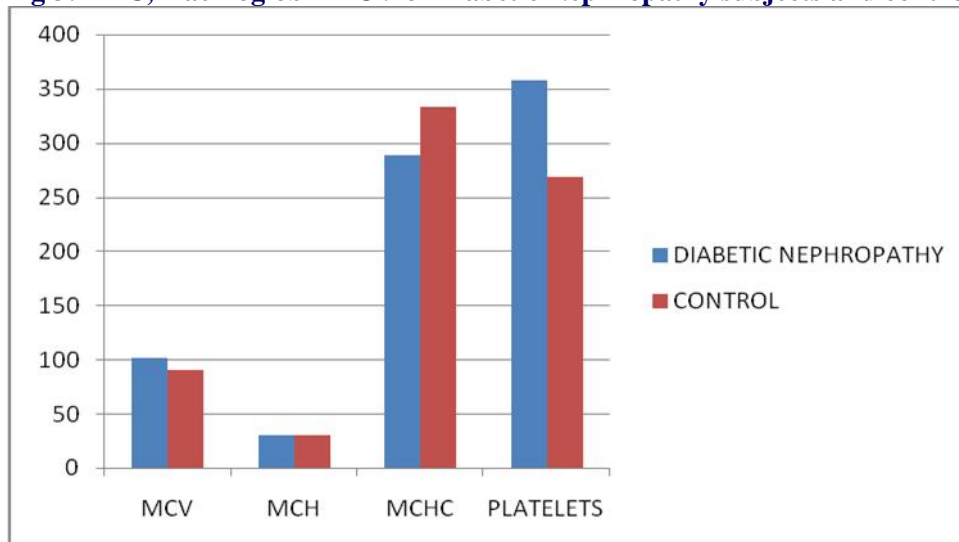


Fig 4: MCV, MCH, MCHC, Platelets of Diabetic Nephropathy subjects and control

Discussion

Diabetes causes a number of changes to the body's metabolism and blood circulation which may combine to produce excess reactive oxygen species that lead to the damage of kidney and it is associated with an increased risk of death in general, particularly from cardiovascular disease [16]. The results showed significant reduction in neutrophil, red blood cell haemoglobin, packed cell volume and mean cell haemoglobin concentration of the diabetic nephropathy subjects compared to the control, significant increase in lymphocyte, monocytes, eosinophil, mean cell volume, and platelet of the diabetic nephropathy subjects compared to the control and no significant difference in ESR, WBC and MCH of the diabetic nephropathy subjects compared to the control. These changes could be attributed to chronic loss of Kidney function [17]. The loss of kidney function will affect the level of erythropoietin. It is associated with an increased risk of death in general, particularly from cardiovascular disease. Anemia may occur in patients with diabetic nephropathy even before the onset of advanced renal failure, and it has been related to erythropoietin deficiency [14, 18]. The increase in lymphocytes, monocytes and eosinophil could stimulate increase release of inflammatory cytokines and chemokines as well as eliciting allergic reactions which may lead to vomiting. This can affect the treatment outcome. The anaemia observed here was mild maybe linked the degree of damage to kidney. Furthermore, anemia has been considered a risk factor for progression of renal disease and retinopathy [15].

Conclusion

The study showed decrease in red cell lines and increase in lymphocytes, monocytes and eosinophil could stimulate increase release of inflammatory cytokines. The anaemia observed here was mild maybe linked the degree of damage to kidney. Diabetic nephropathy patients should be monitored for anaemia and some cytokines that may affect the prognosis of the treatments. It will be necessary to monitor their diets and ensure their sugar level is under control.

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