

Comparative Analysis of some Haematological Indices in Children with Primary Nephrotic Syndrome and Acute Glomerulonephritis

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Summary

Adedoyin OT, Olawumi HO, Anigilaje EA, Ojuawo IA. Comparative Analysis of some Haematological Indices in Children with Primary Nephrotic Syndrome and Acute Glomerulonephritis. *Nigerian Journal of Paediatrics* 2006; 33: 36.

Background: Anaemia occurs in both acute glomerulonephritis (AGN) and nephrotic syndrome (NS). However, the influence of these two renal disorders on other haematological profiles has not been widely and exhaustively studied in Nigerian children.

Objectives: To determine and compare haematological changes that occur in the acute phases of AGN and NS.

Materials and Methods: The haematological profiles of all children admitted to the University of Ilorin Teaching Hospital with a diagnosis of AGN or NS between 1996 and 2004 were compiled. Those excluded from the study were children with NS who had a relapse or had commenced steroid or cytotoxic therapy before admission; others excluded were those with either disease, who had received blood transfusion during the three months immediately prior to the study.

Results: Twenty nine and 28 children with AGN and NS respectively, met the study criteria. The mean packed cell volume (PCV) in children with AGN was 28 ± 5 percent, while that among children with NS was 34 ± 6 percent. Moderate anaemia occurred in 10 (34 percent) children with AGN compared to three (11 percent) with NS. Neutrophilia was present in 45 percent and 54 percent respectively, of children with AGN and NS. Eosinophilia occurred in three (10.3 percent) children with AGN compared to three (10.7 percent) children with NS, and lymphocytosis was present in 11 (37.9 percent) children with AGN compared to 12 (42.9 percent) children with NS.

Conclusion: Severe anaemia was uncommon in the two groups, while children with AGN had lower mean PCV and were more prone to developing moderate anaemia compared to children with NS. Lymphocytosis, lymphopenia and neutrophilia occurred in some children with both conditions.

Key words: Acute glomerulonephritis; nephrotic syndrome; haematology; children

Introduction

ACUTE glomerulonephritis (AGN) and primary nephrotic syndrome (NS) are the leading glomerulopathies seen in children in the tropics,

accounting for over 80 percent of all renal disorders.¹⁻³ Both disorders may be associated with various complications which include haematological abnormalities such as anaemia. Haemodilution, which probably results from associated volume expansion is known to occur in AGN. Inadequate intake of iron and folic acid, bone marrow depression, reduced production of erythropoietin and low grade haemolysis have also been implicated as causal factors of the anaemia in glomerulopathies.⁴ However, while the occurrence of anaemia in the acute phase of both conditions has been widely reported and explained, the influence of the two renal disorders on the other

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common haematological indices has not been widely and exhaustively studied. This study therefore aims at determining and comparing some haematological changes, if any, which occur in the acute phases of both AGN and NS in children seen at the University of Ilorin Teaching Hospital (UITH), Ilorin.

Materials and Methods

The available haematological profiles of all children admitted to the Children's Ward of UITH Ilorin, with a diagnosis of NS or AGN between 1996 and 2004 were compiled. The diagnostic criteria for nephrotic syndrome included the presence of anasarca, massive proteinuria ($>2\text{gm}/24\text{hours}$), hypoproteinemia (serum protein $<2\text{g}/\text{dl}$) and hypercholesterolemia (serum cholesterol $>5.17\text{ mmol}/\text{l}$), while AGN was diagnosed in the presence of haematuria, hypertension, proteinuria and azotaemia. All the patients received standard management for the acute stages of their illnesses except the commencement of steroids in those with NS.

On admission, blood was drawn from each patient and placed in EDTA bottle for the determination of packed cell volume (PCV), white blood cell (WBC) and differential WBC, while peripheral smears for malaria parasites as part of preliminary investigation were also carried out. Children with NS who had a relapse, who were commenced on steroid or cytotoxic agent or who had received blood transfusion during the three months immediately prior to admission, were excluded from the study. Also excluded were children with AGN who had received blood transfusion during the same three months.

The means and standard deviations of the haematological profiles were computed and comparisons made between the two groups using student's t- test. The differences were statistically significant if p was <0.05 .

Definition of terms

Severe anaemia = PCV less than 20 percent, moderate anaemia = PCV 21-25 percent, mild anaemia = PCV 26-29 percent, normal PCV = 30-40 percent.⁵

Normal leucocyte count for the following age groups: 1-3 years, $6.0\text{-}17.5 \times 10^9/\text{l}$; 4-7 years, $5.5\text{-}15.5 \times 10^9/\text{l}$; 8-13 years, $4.5\text{-}13.5 \times 10^9/\text{l}$; >13 years, $4.5\text{-}11.0 \times 10^9/\text{l}$. Values below the minimum of the range for particular age ranges are defined as leucopaenia, while values above the maximum of the ranges describe leucocytosis.⁶

Normal leucocyte differential counts (percentages) range from $2.5\text{-}2.8 \times 10^9/\text{l}$ (45-50 percent) for neutrophils, $2.4\text{-}2.7 \times 10^9/\text{l}$ (40-45 percent) for lymphocytes, $0.05\text{-}0.4 \times 10^9/\text{l}$ (1-8 percent) for eosinophils.⁷

Neutropaenia is present when the absolute neutrophil count is $<1.5 \times 10^9/\text{l}$,⁸⁻¹⁰ while *neutrophilia* exists when

the count is $>2.8 \times 10^9/\text{l}$. *Lymphopaenia* is absolute lymphocyte count of $<2.4 \times 10^9/\text{l}$, *lymphocytosis* refers to absolute lymphocyte count $>2.7 \times 10^9/\text{l}$ and *eosinophilia* when the eosinophil count is $>0.4 \times 10^9/\text{l}$.

Results

Twenty nine children with AGN and 28 others with NS met the study criteria. Children with AGN comprised 19 males and 10 females resulting in a M: F ratio of 1.9:1 while children with NS comprised 19 males and nine females, a M: F ratio of 2.1:1. The ages of the children with AGN ranged from 1.6-15 years with a mean (SD) of $6.7 (\pm 3.7)$ years, while the children with NS were aged 3-17 years with a mean (SD) of $9.4 (\pm 3.8)$ years.

Packed cell volume

The PCV of children with AGN ranged from 20-43 percent with a mean \pm SD of 28 ± 5 percent, while that of children with NS ranged from 23-45 percent with a mean \pm SD of 34 ± 6 percent (Table I). Ten (34.5 percent) of the children with AGN had moderate anaemia, while five (17.2 percent) had mild anaemia. Three (10.7 percent) of the children with NS had moderate anaemia while two (7.1 percent) had mild anaemia. None of the children with AGN or NS had severe anaemia. There was a significant difference between the mean PCV in children with AGN and the mean level in those with NS ($p < 0.05$).

White blood cells

The total WBC count in children with AGN ranged from $2.2\text{-}22.4 \times 10^9/\text{l}$ with a mean \pm SD of $8 \pm 4 \times 10^9/\text{l}$, while that of children with NS ranged from $3.2\text{-}17 \times 10^9/\text{l}$ with a mean \pm SD of $8 \pm 3 \times 10^9/\text{l}$. Twenty-one (72 percent) and 25 (89.3 percent) of the children with AGN and NS respectively, had normal WBC counts. Leucopenia occurred in five (17.2 percent) children with AGN and two (7.1 percent) with NS, while leucocytosis occurred in three (10.3 percent) children with AGN and one (3.6 percent) with NS.

Neutrophil count

Twelve (41.3 percent) and nine (32.1 percent) children with AGN and NS respectively, had normal neutrophil counts. However, neutrophilia was present in 13 (44.8 percent) and 15 (53.6 percent) children with AGN and NS respectively. There was neutropaenia in four (13.8 percent) and four (14.3 percent) children with AGN and NS, respectively.

Lymphocyte count

The lymphocyte count was normal in nine (31.0 percent) and eight (28.8 percent), lymphopaenia occurred in nine (31.0 percent) and eight (28.6 percent), and lymphocytosis was present in 11 (37.9 percent) and 12 (42.9 percent) of children with AGN and NS, respectively.

Table 1

Haematological Indices in Children with AGN and NS

Clinical profile	AGN N=29	NS N=28	P-value
Age (yrs)	6.7 ± 3.7	9.4 ± 3.8	>0.05
PCV	28 ± 5	34 ± 6	<0.05
Mild anaemia	5(17.2%)	2(7.1%)	<0.05
Moderate anaemia	10(34.5%)	3(10.7%)	>0.05
WBC	8 ± 4 x 10 ⁹ /l	8 ± 3 x 10 ⁹ /l	>0.05
Leucopaenia	5(17.2%)	2(7.1%)	>0.05
Leucocytosis	3(10.3%)	1(3.6%)	>0.05
Neutrophils	4.2 ± 0.8 x 10 ⁹ /l	4.2 ± 0.5 x 10 ⁹ /l	>0.05
Neutropaenia	4(13.8%)	4(14.3%)	>0.05
Neutrophilia	13(44.8%)	15(53.6%)	>0.05
Lymphocytes	3.5 ± 0.8 x 10 ⁹ /l	3.5 ± 0.5 x 10 ⁹ /l	>0.05
Lymphopaenia	9(31.0%)	8(28.6%)	>0.05
Lymphocytosis	11(37.9%)	12(42.9%)	>0.05
Eosinophils	0.2 ± 0.2 x 10 ⁹ /l	0.2 ± 0.1 x 10 ⁹ /l	>0.05
Eosinophilia	3(10.3%)	3(10.7%)	>0.05
<i>Plasmodium falciparum</i>	7(24.1%)	7(25.0%)	>0.05

AGN = acute glomerulonephritis

NS = nephrotic syndrome

Eosinophil count

While the eosinophil count was normal in 26 (89.7 percent) and 25 (89.3 percent) children with AGN and NS respectively, eosinophilia occurred in three (10.3 percent) and three (10.7 percent) children with AGN and NS, respectively.

Malaria parasites

The ring forms of *Plasmodium falciparum* were seen in seven patients (24.1 percent and 25.0 percent respectively) with AGN and NS, while one patient with NS had *Plasmodium malariae*. The difference was not statistically significant ($p > 0.05$).

Discussion

The renal production of erythropoietin, a stimulant of erythropoiesis, is reduced or completely ceases in some renal diseases depending on the severity of the renal impairment.¹¹ The consequence is a reduction in red cell production by the bone marrow resulting in varying degrees of anaemia. Nephrotic syndrome and AGN are two common renal illnesses in the tropics capable of affecting haematological functions.

The findings in the present series show that while severe anaemia did not occur in either disease, mild and moderate anaemia occurred more frequently in children with AGN than NS. This finding is in keeping with those reported by other workers.⁴ Anaemia in AGN could be attributed to haemodilution secondary to volume expansion. Haematuria, which is a significant feature of AGN, could also have contributed to the anaemia. Conversely, hypovolaemia is common in children with nephrotic syndrome because of low plasma albumin; therefore, the PCV will tend to rise rather than fall. It is also possible that renal impairment, which is more severe at the onset of AGN, could also have contributed to the difference in the degrees of anaemia.

The total WBC counts in both groups of children were not significantly different. This indicates that the two diseases did not normally affect WBC counts. It is however not known from this study if any other aspect of WBC function was affected. Nevertheless, lymphocytosis or lymphopaenia occurred in an appreciable number of children with both illnesses suggesting that these changes can be important features of the illnesses. Such changes could have been

an aftermath of viral illnesses or the consequence of a cellular reaction to the immune complex nephritis. Similarly, the neutrophilia which occurred in both AGN and NS, would also suggest that it may sometimes be a significant feature of the illnesses. The presence of associated bacterial illness may explain the neutrophilia in the AGN children but not entirely in the children with NS who did not have clinical features suggestive of sepsis except perhaps, there might have been co-existing bacteraemia on admission. These observations need to be validated in a larger number of patients.

The presence of malaria parasitaemia in both groups can be explained by the fact that malaria often co-exists with other illnesses in the tropics. The most common species was *Plasmodium falciparum*, which was found in a few cases, whereas *Plasmodium malariae* which has been implicated in quartan malaria nephropathy in the past,¹² was found in only one case. The role of *P. falciparum* in the two conditions is doubtful as the nephrotic process did not abate after treatment with chloroquine. Indeed, some of the patients with NS subsequently developed relapses.

In conclusion, severe anaemia would appear to be uncommon in the two groups while children with AGN have lower mean PCV and are more prone to developing moderate anaemia compared to children with NS. Lymphocytosis, lymphopaenia and neutrophilia occurred in some children with AGN and NS.

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