

Childhood Acute Glomerulonephritis in Port Harcourt, Rivers State, Nigeria

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Abstract

Background: Acute glomerulonephritis (AGN) is an important cause of renal morbidity and mortality in children. The incidence varies across the countries with lower rates in developed countries due to improved environmental hygiene and socio-economic status.

Methods: A prospective study of patients admitted with the diagnosis of AGN was carried out in the Department of Paediatrics, University of Port Harcourt Teaching Hospital (UPTH) from June 2006 to June 2008. The patients' demographic data, presenting complaints; antecedent history of sore throat or skin infections, clinical findings including blood pressure; investigations, management and outcome were obtained. Data was compared with a previous study done in UPTH 14 years ago and in other countries.

Results: A total of 31 patients aged 3 to 16 years had AGN, giving an annual incidence of 15.5 cases. They comprised 16 (51.6%) males and 15 (48.4%) females with a M: F ratio of 1.1:1. There is no significant change in the annual incidence of AGN when compared with the 14.5 cases per annum reported in our centre 14 years ago. Fourteen (45.2%) of the patients were between 5-10 years. The highest incidence occurred during the dry cold windy (harmattan) season of October to February in 19 (61.3%) patients. Twenty-four (77.4%) of the patients were from low socio-economic classes (social class IV and V). Sore throat was the commonest infection preceding AGN (66.6%). Hypertensive encephalopathy with seizure occurred in 5 (16.1%) patients. There were 4 (12.9.1%) patients with nephrotic range proteinuria, and 12 (38.7%) patients had renal failure. Urinary tract infection occurred in 7 (22.6%) patients; klebsiella being the commonest organism isolated. All patients received conservative treatment while dialysis was done in 5 patients; one peritoneal dialysis (PD) and 4 haemodialysis. The recovery rate was 83.9% and a hospital mortality of 3 (9.7%).

Conclusion: The annual incidence of AGN has remained almost the same in Port Harcourt despite the increased urbanization and overcrowding in this oil rich state of Nigeria.

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Introduction

Acute glomerulonephritis (AGN) is the most common non-suppurative renal disease and an important cause of renal morbidity in childhood^{1,5}. While there has been substantial decline in the incidence of AGN in the developed countries of the world⁶⁻¹⁰, there are reported yearly increases in the incidence with seasonal variations in Africa^{3,4,11-19}. The annual incidence varies from 6.4 patients in Florida, United States of America (USA) to over 200 patients/ year in India^{6,20}. In developing countries, its prevalence is influenced by low socio-economic status and poor environmental hygiene^{2,3,11-19}. Majority of the AGN cases are attributed to post-streptococcal infection^{3,17,18,19}. Cases of AGN has been reported to occur sporadically or in epidemics^{13,17,20,21}. In Nigeria, a previous study done in Port Harcourt 14 years ago noted a prevalence of 14.5 per year¹⁷. We believe that with oil exploratory activities in Port Harcourt affecting the socioeconomic status as well as the environment, there may be changes in the prevalence and epidemiology of AGN. This present study aims to determine any changes in the epidemiology and clinical manifestations of AGN over the years.

Patients and Methods

This was a prospective study carried out in the Department of Paediatrics, University of Port Harcourt Teaching Hospital (UPTH). All children admitted with the diagnosis of acute glomerulonephritis (AGN) over a 2 year period from June 2006 to June 2008 were recruited into the study. The diagnosis of AGN was made based on acute onset of oedema, haematuria and proteinuria of less than 2 weeks duration.

The patients' demographic data, presenting complaints; antecedent history of sore throat or skin infections, clinical examination including blood pressure; investigations, management and outcome

were obtained. The socio-economic status of the family was determined by the criteria used by Oyediji²². Hypertension was defined as systolic and/ or diastolic blood pressure values greater than the 95th centile for age and sex²³. Investigations done included bed-side urinalysis using the multistix strip for the presence and semiquantification of haematuria and proteinuria; urine microscopy for granular and red cell casts; a 24-hour urinary protein estimation and urine culture; serum electrolytes, urea, creatinine, protein, albumin, and cholesterol. Antistreptolysin O (ASO) titer and C3 complement were done. Other investigations included abdominal ultrasonography and chest radiograph for all the patients; computerized tomography done only in the unconscious patients. Percutaneous renal biopsy processed under light microscopy (LM), electron microscopy (EM) and immunofluorescence microscopy (IM) was performed in 3 female patients; one for persistent gross haematuria (PGH) lasting longer than 6 months, another for nephrotic syndrome, and the other for rapidly progressive renal failure unresponsive to clinical management. Cultures of throat or wound swabs were not done.

Data analysis was done using the statistical package Epidemiological Information Software (EPI- INFO version 6). Chi- square (X^2) was used to test proportions while normally distributed data were analyzed using the student's t (unpaired) test. In all cases, a p value of <0.05 was considered statistically significant.

Results

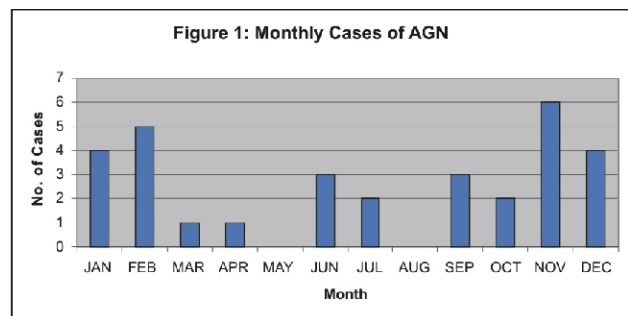
A total of 31 patients had acute glomerulonephritis (AGN) representing 38.3% of the 81 renal cases (excluding urinary tract infection) seen during the study period. This gave an incidence of 15.5 cases per year. They were aged 3 to 16 years (mean 8.12 ± 4.02). There were sixteen (51.6%) males and 15 (48.4%) females with a M:F ratio of 1.1:1. Table I shows the age and sex distribution of the patients. Majority of the patients were between 5-10 years.

Table I: Age and sex distribution of patients with AGN

Age(years)	Male(%)	Female(%)	Total (%)
< 5	3 (18.8)	5 (33.3)	8 (25.8)
5-10	8 (50.0)	6 (40.0)	14 (45.2)
> 10	5 (31.2)	4 (26.7)	9 (29.0)
Total	16 (100)	15 (100)	31(100)

The mean age of the male patients was 8.4 ± 4.2 years while that of the female patients was 7.8 ± 3.9 years.

There was no significant difference between the mean ages of both sexes ($p > 0.05$). Of the 31 patients, 19 (61.3%) were seen during the dry cold windy (harmattan) season of October to February of each year (Figure 1). During the wet humid (rainy) season, there were 12 (38.7%) cases of AGN. There was a significant difference in the seasonal incidence of AGN between the cold dry and rainy seasons ($\chi^2 = 14.19$, $df = 1$; $p < 0.001$). Twenty-four (77.4%) of the patients belonged to families of low socio-economic classes (IV and V); 5 (16.1%) belonged to social classes II and III while 2 (6.5%) were from families of high socio-economic class 1.



Antecedent infection was recorded in 12 (38.7%) patients one to two weeks before the onset of symptoms. The commonest infection preceding AGN was sore throat seen in 8 (66.6%) patients (Table II). No antecedent infection was recorded in 19 (61.3%) of the patients.

Table II: Antecedent infections in patients with acute glomerulonephritis

Type of infection	Number	%
Sore throat	8	66.7
Pyoderma / Impetigo	2	16.7
Both	2	16.7
Total	12	100.0

The clinical presentations are shown in Table 3. Peripheral oedema occurred in all the patients. This was followed by hypertension in 20 (64.5%) patients. Five (16.1%) of the patients had hypertensive encephalopathy with seizure. Five (16.1%) patients had pulmonary edema.

Table III: Clinical presentation of Acute glomerulonephritis

Presentation	Number	%
Oedema	31	100.0
Hypertension	20	64.5
Fever	18	58.1
Oliguria	18	58.1
Cough	13	41.9
Coke coloured urine	12	38.7
Orthopnea	7	22.6
Seizure	5	16.1
Pulmonary oedema	5	16.1
Coma	4	12.9

All 31 patients had macroscopic and microscopic haematuria and proteinuria ranging from 30-500 milligram per deciliter (mg/dl). Four (12.9.1%) patients had nephrotic range proteinuria (equal to or greater than 500mg/dl). Hypoalbuminaemia with serum protein ranging from 20-33 gram per deciliter (g/dl) and hypercholesterolaemia with serum cholesterol ranging from 7.3-8.8 millimole per liter (mmol/L) were found in these four patients. Antistreptolysin O titers (ASO titer) were elevated (greater than 200 Todd units) in 6 patients; serum complement was reduced in these 6 patients [range 1.2-53mg/dl]. The mean serum sodium was 131.5 mmol/L [range 121 - 142 mmol/L]; potassium was 4.2 mmol/L [range 2.2 - 5.7 mmol/L]; bicarbonate was 19.4 mmol/L [range 13 - 24 mmol/L]; urea was 15.1 mmol/L [range 2 - 46.4 mmol/L]; creatinine was 211.6 micromole per liter ($\mu\text{mol/L}$) [range 35-1060 $\mu\text{mol/L}$]. Renal function was deranged in 12 (38.7%) patients with elevated urea (greater than 25mmol/L) and creatinine (greater than 500 $\mu\text{mol/L}$). Urinary tract infection occurred in 7 (22.6%) patients; klebsiella was the isolated organism in 5 (71.4%) of these patients.

Chest radiography showed diffuse perihilar infiltrates (butterfly distribution) with engorged lymphatics in interlobular septa demonstrated as peripheral and horizontal lines (Kerley B) in 5 (16.1%) patients and cardiomegaly in 2 (6.5%) patients. Abdominal ultrasonography showed symmetrically enlarged kidneys in 20 (64.5%). Brain computerized tomography (CT scan) was done in two patients who could afford the cost revealed cerebral oedema. Percutaneous renal biopsy was performed in 3 female patients; one for persistent gross haematuria (PGH) lasting longer than 6months, another for persistent massive proteinuria lasting more than 3months, and the other for rapidly progressive renal failure unresponsive to clinical management. Light microscopy (LM) of the renal tissue of the patient with PGH showed crescent deposits in the Bowman's capsule

(fig2), suggestive of crescentic AGN. Immunofluorescence microscopy (IM) revealed deposits of IgA and complements on the glomerular basement membrane (GBM). However, her serum IgA level was normal at 1.31g/dl (0.6-3.0g/dl). The biopsy report of the others suggested focal segmental glomerulosclerosis (FSGS).

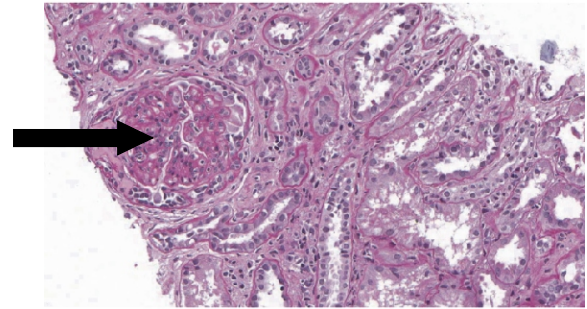


Figure 2: Light microscopy shows crescent deposit in the glomeruli (arrow).

The treatments given were conservative management or dialysis. All the patients received antibiotics; oral or intravenous amoxicillin 100mg /kg/day in three divided doses given for 10 days to two weeks. Patients with severe hypertension received intravenous hydralazine 0.1-0.5mg/kg repeated every 4-6hours as necessary. They were maintained on oral hydralazine 0.25-0.5mg/kg given 8hourly; intravenous and oral frusemide 2mg/kg/day and oral captopril 0.1mg/kg (max 6.25mg) first dose, increased gradually depending on blood pressure to 0.1-0.3mg/kg(12.5-25mg) 2-3 times a day. Amlodipine 5-10mg once a day was used in 2 patients who could afford the drug. Intravenous mannitol 1g/kg/dose over 30 minutes 8 hourly for 24 hours was given to 2 (6.5%) patients with cerebral oedema. Two (6.5%) patients with seizures had intramuscular paraldehyde to abort the seizures.

Five (16.1%) patients had dialysis due to failure of conservative measures; intractable hypertension (2), uraemia (3). One (8yr old female) had peritoneal dialysis (PD), while 4 (>10years; 2 females and 2 males) had haemodialysis (HD).

Outcome

All the patients were admitted into the childrens' medical or emergency wards. The mean duration of admission was 12.3 ± 9.6 days (range 5 - 46 days). The average time for resolution of symptoms were as follows; blood pressure 17.7 ± 26.2 days (range 2 - 120 days); haematuria 21.6 ± 36.8 days (range 4 - 160 days) and proteinuria 13 ± 11.2 days (range 3 - 28 days). Three

patients died in the hospital giving a mortality rate of 9.7%. Two patients died from intractable hypertension and one from uraemia. Twenty six (83.9%) patients were discharged, of which 15 (48.4%) had complete resolution of symptoms before discharge. Seven (22.6%) patients defaulted from follow-up. Six (19.1%) patients are still being followed up in our clinic. Two (6.4%) patients have developed chronic renal failure after 6 months and are on chronic dialysis.

Discussion

This study has shown that acute glomerulonephritis (AGN) is an important cause of renal morbidity in children. The yearly incidence of 15.5 cases per year is almost similar to the 14.5 cases per year reported by Eke et al¹⁷ 14 years ago in our center. Despite the increased urbanization and overcrowding in this oil rich city of Nigeria, the yearly incidence of AGN has remained almost the same. The incidence also compares favorably with the rate of 9 - 17 per annum reported by Ibadin et al¹⁵ in Southern Nigeria and the 12 cases per annum reported by Hutt et al⁴ in Uganda. It is however lower than the 31 - 50 annual incidence reported in other centers in Nigeria^{14,18,19} and much lower than the 124 cases per year reported by Wesley et al²¹. The male preponderance noted in this study although not significant has also been reported in earlier study in this centre¹⁷ and in other parts of Nigeria^{15,18}, South Africa⁵, Afghanistan²⁴, and in the USA⁶.

Antecedent streptococcal infection has been implicated as a causal factor in AGN¹. In tropical countries, skin infections are the commonly encountered antecedent infections while in temperate climates, pharyngeal infections are more common²⁵. In our present study antecedent infection was recorded in only 38.7% of the patients, majority (66.7%) following pharyngeal infection. This is higher than the 54.0% reported in an earlier study in our centre¹⁷. Also, in Libya³, pharyngeal infection was the most common antecedent infection. Environmental changes consequent upon gas flaring prevalent in our environment may have contributed to a higher rate of pharyngeal infections seen in the present study. However in other studies across Nigeria^{15,18,19}, pyoderma was the common antecedent infection. The elevated ASO titer and reduced C3 complements in some of our patients suggested poststreptococcal acute glomerulonephritis (PSAGN) as a causal factor. However, we were unable to do throat or skin culture for the patients. Endemicity of poststreptococcal acute glomerulonephritis (PSAGN) are known to be associated with pharyngeal infections and are usually seasonal^{17,20,26}. Majority of AGN cases in this study

presented during the cold dry season, similar to that reported by Aikhonibare et al¹⁹ in Northern Nigeria.

AGN is known to be influenced by poor socio-economic status and poor environmental hygiene^{3,11-19}. In our present study, 96.0% of the patients were from families of low socio-economic status. This finding supports previous studies from different centers in Nigeria¹⁵⁻¹⁹.

Acute glomerulonephritis (AGN) is associated with some complications. The 64.5% prevalence of hypertension in the present study is comparable to the 63.7% from an earlier study in this center¹⁷ and in other parts of Nigeria¹⁸. It is however lower than the 82.5% reported by Ibadin et al¹⁵ in southern Nigeria but higher than the 60.9% reported by Hutt et al⁴ in Uganda and the 49.0% reported by Singh et al²⁴ in Afghanistan. The observed difference in the prevalence of hypertension in these countries may be attributed to varying blood pressure criteria used in the definition of hypertension. The 16.1% prevalence of hypertensive encephalopathy is quite high compared to the 2 - 4.8% prevalence recorded in some centers in Nigeria^{15,19} and in the Middle East²⁴ but is comparable to the 11.6% prevalence recorded by Okafor et al¹⁸ in Enugu, Southern Nigeria¹⁸. The higher prevalence of hypertensive encephalopathy may be attributed to the high prevalence of hypertension recorded in this study.

Acute renal failure (ARF) occurred in 12 (38.7%) patients. This is lower than the 85.0% cases reported in the Middle East²⁴. However, only 5 (16.1%) patients were dialyzed due to failure of conservative measures. Intractable hypertension with uraemia was the commonest reason for dialysis. Peritoneal dialysis (PD) was used in younger patient while the older patients who had better vascular access received haemodialysis (HD).

The 16.7% prevalence of acute pulmonary oedema is slightly lower than 20.4% prevalence recorded in an earlier study in our center¹⁷ but much lower than the 39.7% prevalence recorded by Ibadin et al¹⁷ in Southern Nigeria and higher than the 7.0% reported by Okafor et al¹⁸ in Eastern Nigeria.

Studies in Africa have shown that children with AGN tend to present with features of nephrotic syndrome^{17,27}. This was found in 4 (12.9%) patients, and it's lower than the prevalence reported in some centers across Nigeria^{15,18,19}. The relationship between AGN and UTI is not well established and there is paucity of data on the

prevalence of UTI in children with AGN²⁷. The 22.6% prevalence of urinary tract infection in this study is comparable to the 24.1% prevalence reported by Ibadin et al²⁷ in Southern Nigeria. However, nephrotic syndrome which occurred in some of the patients may have predisposed the patients to UTI due to loss immunoglobulins and protein in urine^{17,27,28}.

The long term outcome of childhood AGN is generally very good with recovery rate of over 95% compared to adults^{21,28,29}. In our present study, the recovery rate was 83.9%, although complete resolution of symptoms before discharge was seen in 48.4%. The default rate is high at 22.6%, with only 6 (19.1%) patients on follow-up. The distance of our hospital from town, as well as poor follow-up system apparent in our facility makes it difficult for long term follow-up of most of our patients. The fact that AGN can cause chronic renal failure (CRF)^{28,29} was supported by this study.

The high mortality rate of 9.7% obtained in this study when compared with 1.2 - 3.2% rate in other parts of the country^{14,17,18} may be attributed to a very high cost of dialysis limiting the number of sessions; hence one patient died from uraemia. It is also higher than the 2.7% rate reported in an earlier study in our center¹⁷.

In conclusion, acute glomerulonephritis (AGN) in an important cause of the renal morbidity in Nigerian children. The prevalence in our environment has remained almost the same despite increased urbanization, overcrowding and environmental changes from gas flaring resulting from rising oil exploratory activities in Port Harcourt. Hypertension is a common feature and mortality from AGN is high from hypertensive encephalopathy and uremia.

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