

## Original Research Article

# Clinical profile and excellent short-term treatment outcome of acute glomerulonephritis: a report from paediatric nephrology unit of university teaching hospital, Uyo, Nigeria

Ofonime T. DixonUmo\*, Enobong E. Ikpeme, Kate M. Kan

Department of Pediatrics, University of Uyo Teaching Hospital, P.M.B 1136, Uyo, Nigeria

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**\*Correspondence:**

Dr. Ofonime T. DixonUmo,

E-mail: ofonuuth@yahoo.com

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### ABSTRACT

**Background:** Acute glomerulonephritis (AGN), the commonest of which is acute post streptococcal glomerulonephritis, is common in school aged children and typically presents with haematuria, oedema, oliguria and varying degrees of renal insufficiency. This study evaluated epidemiologic factors, presentations and treatment outcome of AGN patients at University of Uyo Teaching Hospital, (UUTH), Uyo, Nigeria.

**Methods:** This cross-sectional study was conducted among children with AGN at the paediatric nephrology unit of UUTH from January 2015 to December 2019. Data were analysed with statistical package for social sciences version 25 and p values <0.05 were considered statistical significant.

**Results:** Fifteen out of 12,403 paediatric admissions had AGN, giving an average yearly hospital incidence of 3/year and 0.12% of total admission. Age range was three to 15 years. Mean age was  $8.07 \pm 3.94$  years and median was 7.00 years. Males were nine with a male/female ratio of 1.5:1. Eight (53.3%) belonged to the lowest socioeconomic class. Haematuria and peripheral oedema were universal presentations and 4 (26.7%) had antecedent pharyngeal infection. Other clinical presentations were: Oliguria 11(73.3%), Grade II hypertension 10 (66.7%), and pulmonary oedema 5 (33.3%). Four (26.7%) each had acute kidney injury, hyperkalaemia and dipstick massive proteinuria. Other complications were congestive cardiac failure 2 (13.3%), and seizures with encephalopathy in 1 (6.7%). Proteinuria was significantly associated with age at  $p=0.034$  (Fisher Exact test). Major treatment modalities were: fluid management, loop diuretics and antibiotics as indicated.

**Conclusions:** Short-term outcome was excellent with 100% discharge within 28 days of hospitalisation and the majority being discharged within two weeks.

**Keywords:** Acute glomerulonephritis, Children, Outcome, Presentations

### INTRODUCTION

Acute glomerulonephritis (AGN) is characterised by the pathological process of acute inflammation and/or cellular proliferation of the glomeruli without a direct kidney infection.<sup>1</sup> It is most commonly a sequel of the nephritogenic group A beta haemolytic streptococci. The classical manifestation of AGN is an acute nephritic syndrome which presents clinically with an abrupt onset of haematuria in varying combination with oedema,

hypertension, and differing degrees of diminishing renal function.<sup>1,2</sup>

Acute glomerulonephritis has a global occurrence but the incidence is lower in developed countries with high standards of hygiene. Resource-rich countries like United States of America, United Kingdom, Central Europe and Japan have documented remarkable reductions of the incidence of AGN in the past few decades.<sup>3</sup> Conversely, poststreptococcal AGN is still a very common cause of

paediatric kidney injury in the Middle East and African countries.<sup>4</sup> AGN is usually associated with an antecedent pharyngeal infection in one to two weeks or a pyoderma after two to four weeks.<sup>1,2,5</sup> Studies have shown a male preponderance of up to 2:1 male to female ratio.<sup>1,6-9</sup> It occurs more in children between the ages of 4-14 years of age and is rare in children less than two years.<sup>10</sup> Other associated epidemiologic factors including tropical climate, low socio socioeconomic status, crowded conditions, poor hygiene, among others, have also been documented.<sup>2</sup>

Sub-clinical disease occurs in about 50% of the cases with affected children being discovered accidentally on routine urinalysis.<sup>11</sup> This is usually characterised by reduced serum complement levels, significant microscopic haematuria with elevated or normal blood pressure. Studies of household members in non-epidemic situations showed 4-10 times greater prevalence of asymptomatic compared to the symptomatic presentation.<sup>12,13</sup> Acute nephritis could also present with complications including nephrotic syndrome and rapidly progressive (crescentic) glomerulonephritis in 4-10% and 0.5% of cases respectively.<sup>14</sup> Hypertension has been reported in 60-80% of children with up to 50% requiring antihypertensive therapy, and may lead to encephalopathy.<sup>10</sup> Congestive cardiac failure may develop from uncontrolled hypertension or hypervolaemia and a few patients may develop pulmonary oedema which is one of the common causes of mortality in the acute phase.<sup>14</sup> Acute kidney injury may also occur and may be severe enough to require dialysis.<sup>6,7,15</sup> Though mortality during the acute phase may result from complications and the challenges of managing them, short term prognosis have been reported to range from 84 to 100%.<sup>6,7,15-17</sup>

This study was conducted to document the epidemiologic factors, clinical presentations and short-term outcome of treatment of children with acute glomerulonephritis managed at the paediatric nephrology unit of a low-resource tertiary health facility in Uyo, Nigeria.

**METHODS**

This was a prospective hospital-based longitudinal study of children admitted into the nephrology unit of University of Uyo Teaching Hospital, Uyo, from 1st January 2015 to 31st December 2019. The biodata and social classes of the patients were determined using Oyedeji's social classification system.<sup>18</sup> Information including presenting complaints, examination and investigation findings, diagnosis, and treatment outcome were recorded. Acute glomerulonephritis (AGN) was diagnosed in patients presenting with sudden onset of oedema and significant haematuria; accompanying elevated blood pressure, oliguria and diminished renal function. Treatment modalities included administration of loop diuretics, anti-hypertensive agents and antibiotics as indicated. Complications of acute kidney injury (AKI), electrolyte derangement, encephalopathy, congestive

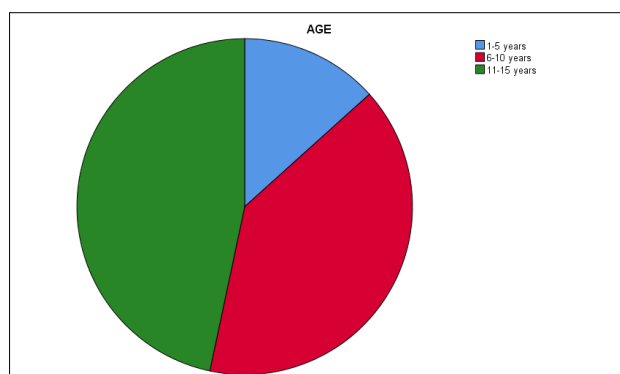
cardiac failure were managed conservatively and none of the patients required dialysis. Discharged patients were followed-up in the paediatric nephrology clinic.

Data were inputted into Microsoft Excel spreadsheet but analyses were done with statistical package for social sciences (SPSS) version 25. Statistical mean with standard deviation were compared using Student T test, chi square was used to compare proportions for statistical analysis. Statistical significant p-value was set at p<0.05.

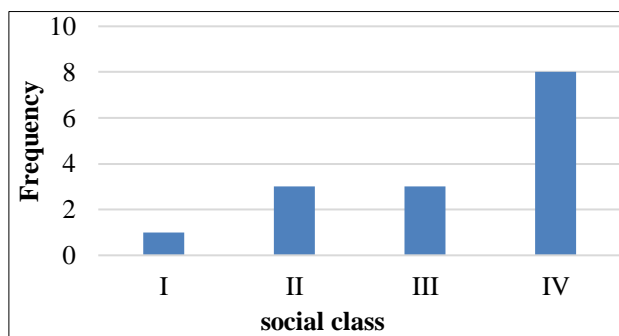
Ethical approval was obtained from the University of Uyo Teaching Hospital's Institutional Health Research Ethical Committee (IHREC). Informed consent was obtained from parents/caregivers of all the children.

**RESULTS**

Up to 12,403 children were admitted during the study period of which 15 had a diagnosis of AGN, constituting 0.12% of total paediatric admissions and a hospital-based incidence of three cases per annum. Nine (60%) of the 15 patients were males, giving a male to female ratio of 1.5:1, with a mean age of 8.07±3.94 years. The age range was three to 15 years with a median age of 7.00 years. Figure 1 shows a pie chart of the age distribution of the 15 patients. Seven (46.7%) were in the 11-15 years age group while only 2(13.3%) were in the 1-5 years age group.



**Figure 1: Distribution of study population according to age group.**



**Figure 2: Distribution of 15 AGN patients according to their social classes.**

Figure 2 is a bar chart of the distribution of patients according to their social classes. Eight (53.3%) were in social class IV, there was none in social class V and only one (6.7%) of the patients belonged to social class I. There were 3(20.0%) each in social classes II and III.

Table 1 shows the frequencies and percentages of clinical features of the patients. Everyone presented with periorbital oedema and lower limb oedema while 14 (93.3%) had ascites. Hypertension (stages I and II) occurred in 13 (86.7%) of the patients, eleven (73.3%) and 9 (60.0%) patients presented with oliguria and gross haematuria respectively while 5 (33.3%) were febrile and 4 (26.7%) had a preceding history of sore throat.

Table 2 shows the investigation results of the patients. Three (20.0%) patients could not afford payment for serum creatinine, urea and electrolytes. Seven (46.7%) patients could not afford renal ultrasound scan and the findings were normal in those who did the scan.

Microscopic haematuria occurred in all the patients but proteinuria was noted in 12 (80.0%) patients, 4 (26.7%) of which were in nephrotic range. Hyperkalaemia and elevated serum creatinine levels were noted in each of 4 (26.7%) patients, acidosis occurred in three (20.0%) and hypernatraemia in 6 (40.0%) of the patients.

Table 3 shows the chi-square test analysis of complications of AGN in relation to the age of the

patients. One of the complications, massive proteinuria (426.7%), had a statistically significant association with age ( $p=0.034$ , Fisher's Exact test), occurring more in older children. There was no significant association between age and gender with seizures (1[6.7%]), elevated blood pressure (13[86.7%]), pulmonary oedema 5 (33.3%), congestive cardiac failure (2[13.3%]) and acute kidney injury 4 (26.7%). The duration of hospitalisation ranged from 6 to 28 days.

**Table 1: Clinical presentation of patients with acute glomerulonephritis.**

Clinical presentation	Frequency	Percentage
Facial (periorbital) oedema	15	100.0
Lower limb oedema	15	100.0
Ascites	14	93.3
Elevated blood pressure	13	86.7
Oliguria	11	73.3
“Coke”-coloured urine	9	60.0
Pulmonary oedema	5	33.3
Acute kidney injury	4	26.7
Congestive cardiac failure	2	13.3
Seizures	1	6.7

Figure 3 shows this duration of hospitalisation and most patients, 7 (46.7%) were discharged within 8 to 14 days with the longest being one (6.7%) patient who stayed on for 28 days.

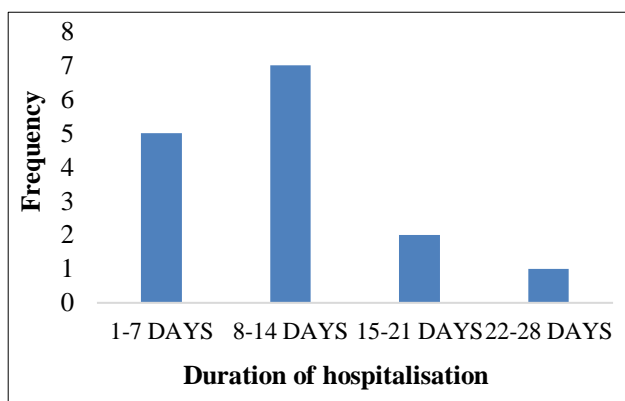
**Table 2: Frequency and percentages of investigation results of patients with acute glomerulonephritis.**

Investigation		Frequency	Percentage
Dipstick haematuria	+++	15	100.0
	Not detected	3	20.0
Dipstick proteinuria	+	2	13.3
	++	6	40.0
	+++	4	26.7
	50-100	8	53.3
Serum creatinine (µmol/l)	100-400	4	26.7
	Not done	3	20.0
	2.0-7.0	6	40.0
Serum urea (mmol/l)	>7.0-20.0	6	40.0
	Not done	3	20.0
	135-145	9	60.0
Serum sodium (mmol/l)	146-155	3	20.0
	Not done	3	20.0
	3.2-5.2	8	53.3
Serum potassium (mmol/l)	>5.2	4	26.7
	Not done	3	20.0
	<20.0	3	20.0
Serum bicarbonate (mmol/l)	20.0-28.0	9	60.0
	Not done	3	20.0
	Normal	8	53.3
Renal ultrasound scan	Not done	7	46.7

**Table 3: Chi square analysis of age of patients and complications of AGN.**

Age / Complication		1-5 years/ (%)	6-10 years/(%)	11-15 years/(%)	Total (%)	p-value
AKI	Yes	0 (0.0)	3 (20.0)	1 (6.7)	4 (26.7)	0.229
	No	2 (13.3)	3 (20.0)	6 (40.0)	11 (73.3)	
Pulmonary oedema	Yes	1 (6.7)	1 (6.7)	3 (20.0)	5 (33.3)	0.526
	No	1 (6.7)	5 (33.3)	4 (26.7)	10 (66.7)	
Dipstick protein	Nil	2 (13.3)	1 (6.7)	0 (0.0)	3 (20.0)	0.034*
	+	0 (0.0)	2 (13.3)	0 (0.0)	2 (13.3)	
	++	0 (0.0)	2 (13.3)	4 (26.7)	6 (40.0)	
	+++	0 (0.0)	1 (6.7)	3 (20.0)	4 (26.7)	
Seizures	Yes	0 (0.0)	0 (0.0)	1 (6.7)	1 (6.7)	0.542
	No	2 (13.3)	6 (40.0)	6 (40.0)	8 (53.5)	
Cardiac failure	Yes	1 (6.7)	0 (0.0)	1 (6.7)	2 (13.3)	0.196
	No	1 (6.7)	6 (40.0)	6 (40.0)	13 (86.7)	
Elevated blood pressure	Nil	0 (0.0)	1 (6.7)	3 (20.0)	5 (33.3)	0.837
	Stage I	0 (0.0)	1 (6.7)	2 (13.3)	3 (20.0)	
	Stage II	2 (13.3)	4 (26.7)	4 (26.7)	10 (66.7)	
	Total	2	6	7	15 (100.0)	

\*Fisher’s Exact Test/significant value



**Figure 3: Duration of hospitalization of 15 AGN patients.**

There was no recorded mortality; none of the patients was discharged against medical advice and 100% of them recovered from the acute phase of the illness. The patients with massive proteinuria recovered while awaiting work-up for commencement of steroid therapy. Over 50% are on follow-up with normal kidney function.

**DISCUSSION**

Fifteen paediatric patients presented with AGN over a five-year period, giving an average annual hospital incidence of three cases per annum. Though this is the lowest reported in southern Nigeria; comparing the reports from, Warri, Port-Harcourt and Calabar, it is close to the report from Umuahia where 19 cases were seen over a six-year period.<sup>6-8,16</sup>

This may show that the improvement in our standard of hygiene is approaching what contributes to low incidence

in developed countries, but a community survey would be a more realistic assessment.<sup>3</sup>

The male preponderance here agrees with previous reports in Nigeria and India but differs from the report from Benin-City where more females were affected.<sup>5-8,15,19</sup> The age range is akin to earlier observation of 3-13 years and a mean age of 8 years reported by Ugwu and 2-15 years by Ibeneme et al but the peak age is higher than >5-10 years reported by Ugwu.<sup>16,7</sup> The lower representation of pre-school age resembles the report of Ibeneme et al and Ugwu.<sup>7,16</sup> The highest representation of the lowest socioeconomic status and least represented group being from the highest social class corroborate the findings of: Sharmin, Ibeneme et al and Ugwu, among others.<sup>5,7,16</sup>

A preceding history of throat infection is very much like the 25% from the study at Warri<sup>16</sup> but higher than 14.7% from Calabar.<sup>6</sup> It was much lower than 53.8% and 86.0% from Benin-City and Port-Harcourt respectively.<sup>8,19</sup> There was no preceding history of pyoderma, a disparity from the studies at Benin-City and Umuahia where antecedent pyoderma was found in 7.7% and 10.5% respectively. This shows that a preceding skin infection may not be an important antecedent of acute poststreptococcal glomerulonephritis in our locale.

Haematuria, a constant feature of AGN, had 100.0% occurrence, though gross haematuria (cola-coloured) urine was lower in comparison to 85.5% and 70.0% reported from Calabar and Warri respectively.<sup>6,16</sup> Periorbital and lower limb oedema also showed a universal occurrence which was lower than 95.0% reported by Sharmin.<sup>5</sup> Other authors including: Etuk et al, Ibeneme et al, and Ugwu reported varying prevalence of



oedema of 98.5%, 94.7% and 80.0% respectively.<sup>6,7,16</sup> Ascites was also reported by Ibeneme et al, though at a lower proportion of 78.9%, but Etuk et al found a much lower presentation of 20.0%.<sup>6,7</sup> Elevated blood pressure was higher than 57.9% and 55.0% from the studies by Ibeneme et al and Ugwu respectively; but a higher level, 92.3%, was reported by Ocheke.<sup>20</sup> Oliguria and AKI were at lower proportions than the report of Ibeneme et al and Ugwu.<sup>7,16</sup> Nephrotic range proteinuria was also lower than previous reports and resolved without initiation of steroid therapy.<sup>7,16,21</sup> Mild elevations of serum creatinine, urea and electrolytes were logically present in patients with AKI but resolved with conservative treatment without the resort to dialysis. One of the patients with AKI developed pulmonary oedema in addition to four others whose oedema did not resolve in the first week of admission. All the patients responded to fluid management, diuretics and oxygen therapy.

Hypertension was the commonest indication for acute phase management and was associated with encephalopathy in only one patient. Two patients also developed congestive cardiac failure from hypertension and hypervolaemia. All patients responded to antihypertensive therapy and were normotensive prior to discharge.

Proteinuria was the only clinical entity with a statistically significant association with age. Massive proteinuria however could not be confirmed by quantitative early morning urine protein to creatinine ratio as the patients could not afford the cost. Inability to do renal investigations due to financial constraints was previously reported by Dixon-Umo et al.<sup>22</sup>

The duration of hospitalisation compares favourably with the findings of Ugwu where majority of the patients were discharged within two weeks of hospitalisation and only 10.0% stayed on beyond three weeks.<sup>16</sup> None of the patients were discharged against medical advice in agreement with findings from Ugwu's study and contrasts with documentation of one discharge against medical advice recorded by Ibeneme et al.<sup>7,16</sup> There were also reports of discharge against medical advice from Calabar, Uyo, and Port Harcourt.<sup>6,22,23</sup>

The short-term outcome of this study was excellent with 100% discharge rate, no mortality and no cases of persistent proteinuria or progression of AKI to chronic kidney disease. Excellent prognosis of was also reported by Kasahara et al among 138 children managed for acute poststreptococcal glomerulonephritis.<sup>17</sup> Prognosis from previous Nigerian studies though also good was associated with few cases of mortalities.<sup>6,7,16</sup>

## CONCLUSION

Childhood acute glomerulonephritis in our centre has similar clinical profile from previous studies and is associated with an excellent short-term outcome.

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