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Original Research

Clinical Profile Of Acute Glomerulonephritis In Children

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Abstract

Background: Acute glomerulonephritis is one of the most common cause of acute renal failure in schooling population. AGN in children mostly has infectious origin but non infectious cause should also be kept in mind. Although deaths are rare, serious complications like hypertensive emergencies, encephalopathy, congestive cardiac failure, renal failure can occur.

Objective: This study attempts to evaluate the various clinical presentation, complications and follow up of acute glomerulonephritis.

Material and Methods: This is a prospective observational study conducted over a period of one and a half year between January 2020 and July 2021 in children with confirmed clinical diagnosis of AGN admitted in pediatric ward of Indira Gandhi Institute of Child Health, Bengaluru.

Result: A total of 66 children were included in the study of which male children constituted 37 (56.1%) cases and 29 (43.9%) were females. Majority of the children were between age group of 6-10 years with mean age being 8.9 years. 35 (53%) cases had history of preceding infection, with pyoderma being predominant seen in 27 (40.9%) cases and sore throat seen in 8 (12.1%) cases. The consistent complaint was edema, oliguria and hematuria. ASLO was positive in 30 (45.45%) cases. 65 (98.48%) cases had low C3 level at presentation. Renal biopsy was required in 16 (24.2%) cases. 39 (59%) cases developed complications and the most common was acute kidney injury seen in 17 (25.7%) cases followed by hypertensive encephalopathy in 15 (22.7%) cases. The most common etiology was PIGN seen in 53 (80.3%) cases others were SLE in 9 (13.6%) cases, MPGN in 3 (4.5%) cases, HSP nephritis in 1(1.5%) case. 12 (18.88%) cases had persistent low C3 level at 3 months follow up. Among 66 children with AGN, 39 (59.1%) children had complete recovery at 3 months and 58 (87.88%) children had complete recovery at 6 months in both clinical and laboratory parameters.

Conclusion: Early identification, monitoring for complications and early intervention is required to prevent morbidity and mortality. The study highlights the need for long term follow up to prevent end stage kidney disease.

Keyword: Acute glomerulonephritis, follow up

INTRODUCTION

Acute glomerulonephritis (AGN) is defined as glomerular diseases presenting with acute nephritic syndrome which include sudden onset gross hematuria, proteinuria, oliguria, hypertension, edema and renal insufficiency.[1]
Although pathogenesis of AGN is not completely understood, evidence supports that most cases are due to immunologic response which in turn activates number of biological processes that result in glomerular inflammation and injury which are mediated by infectious agents like viral, bacterial, protozoal or due to non infectious causes like Henoch Schonlein purpura nephritis, Lupus nephritis. AGN is divided into primary that is involving kidney alone or secondary as a part of systemic disorder.[2]
Post streptococcal glomerulonephritis(PSGN) continues to be the most common cause of AGN and usually has antecedent history of group A streptococcal infection as either pharyngitis or pyoderma; usually seen in 5-12 years of age twice as frequent in males compared to females.[3]

The clinical manifestations generally resolves rapidly. Diuresis begins within one to two weeks, serum creatinine returns to previous baseline by four weeks. Hematuria resolves within 6 months. Proteinuria also falls during recovery but mild proteinuria is present in 15% of patients after 3 years and in 2% patients after 10 years. Hypocomplementemia resolves by 12 weeks and if persistently low beyond 12 weeks is an indication for renal biopsy. [3,4]
AGN is one of the common causes requiring admission in children and also an important cause of acute renal failure in developing countries. Although deaths are rare, serious complications like hypertensive emergencies, congestive cardiac failure, renal failure, encephalopathy, retinopathy can occur.[4]
There are only few studies of AGN regarding clinical profile detailing the complications from hospital. Even non infectious causes should also be kept in mind. Early identification, monitoring and management is required to prevent morbidity and mortality. Patients with persistently low C3 beyond 12 weeks helps the clinician to recognize patients who need long term follow up for worsening renal parameters.
This study is to determine various clinical manifestations and complications and to identify the cases which need follow up.[3,5]

MATERIAL AND METHODS:

This is a prospective observational study of patients with confirmed clinical diagnosis of AGN admitted at Indira Gandhi Institute of Child Health, Bangalore. The study will be conducted over a period of one and half year from January 2020 to July 2021.

INCLUSION CRITERIA:

Children between the age group of 1 year to 18 years diagnosed as AGN with or without systemic symptoms.

EXCLUSION CRITERIA:

Children with pre existing renal disease.
Children with preexisting hypertension or proteinuria.

METHOD OF DATA COLLECTION:

Informed consent was obtained from the parents of these patients after giving them details of the

study. Patients with confirmed clinical diagnosis of AGN age 1- 18 years admitted in pediatric ward of Indira Gandhi Institute of Child Health were enrolled.
Detailed history was taken. Hypertension is defined as systolic and /or diastolic blood pressure $\geq$ 95th centile for that age, sex and height measured at 3 occasions [6]. Hematuria is defined as more than 5 RBC's per high power field in 10ml of centrifuged freshly voided urine sample. Oliguria is defined as urine output <1ml/kg/hr. Proteinuria defined as more than 4 mg/m^2/hr. Sun nephrotic/nephritic range proteinuria was taken as 1+ and 2+ of urine albumin and nephrotic range proteinuria is 3+ and 4+ of urine albumin. Age appropriate range of serum creatinine was taken [7]. Evidence of recent streptococcal infection was made if ASLO titre is more than 200 Todd units. Serum C3 was taken decreased if below 75 mg/dl estimated by immunoturbidimetric assay.

Renal biopsy was done in indicated cases: 1. Systemic features: fever, rash, joint pain, heart disease. 2. Absence of serologic evidence of streptococcal infection; normal C3. 3. Mixed features of glomerulonephritis and nephrotic syndrome. 4. Severe anemia; high levels of blood creatinine or anuria (suspected Rapidly progressive glomerulonephritis). 5. Delayed resolution: a) Oliguria, hypertension and/or azotemia persisting beyond 7-10 days. b) Gross hematuria persisting beyond 3-4 weeks. c) Nephrotic range proteinuria beyond 2 weeks. d) Low C3 levels beyond 12 weeks. e) Persistent proteinuria beyond 6 months. f) Persistent microscopic hematuria beyond 12-18 months.
All the patients were followed up for a period of 3 months and 6 months to look for renal function parameters and monitor blood pressure. Serum C3 levels was monitored at 12 weeks

RESULTS:

A total of 66 children with AGN were included in this study. Out of 66 children, 37(56.1%) were male and 29(43.9%) were female. Male to female ratio was 1.28:1 Majority of the children were between the age group of 6 -10 years. Mean age was found to be 8.9 years.
45(68.2%) children belonged to rural areas and majority of the cases (80.4%) were during rainy and winter season.
In our study, 35 (53%) had history of preceding infection. Skin infection was predominant seen in 27 (40.9%) of them and sore throat was seen in only 8 (12.1%) children.
The most common presenting complaint was edema seen in 59 (89.4%) cases, followed by oliguria in 56 (84.8%) cases and hematuria in 55 (83.3%) cases.

Table 1: Clinical manifestation of study population

		Frequency(N)	Percentage %
a. Edema		59	89.4
	Face	38	57.6
	Generalized	21	31.8
b. Decreased Urine Output		56	84.8
c. Cola Coloured Urine		55	83.3
d. Vomiting		22	33.3
e. Headache		20	30.3
f. Fever		17	25.8
g. Convulsion		15	22.7
h. Breathlessness		11	16.7
i. Altered Sensorium		7	10.6
j. Pain abdomen		6	9.1
k. Blurring of Vision		2	3.0
l. Joint Pain, Oral Ulcer		1	1.5
m. Palpitation		0	0

At presentation 57 (86.36%) children had hypertension. 39 (59.1%) had Stage 1 hypertension and 18 (27.3%) had stage 2 hypertension.

Table 2: Hypertension of the study population

	Frequency(N)	Percentage %
<95TH centile - No HTN	9	13.6
95th to 95th +12 centile-Stage 1 HTN	39	59.1
> 95Th +12 centile- Stage 2 HTN	18	27.3

Urine analysis showed nephritic range proteinuria in 51 (77.27%) cases and nephrotic range proteinuria in 15 (22.7%) cases. Gross hematuria was seen in 46 (69.7%) cases and microscopic hematuria in 20 (33.3%) cases. Pus cells was present in 22 (33.3%) cases. 17 (25.7%) cases had elevated serum creatinine and 8 (12.1%) cases had hyperkalemia at admission.

Table 3: Urine anlysis of study population

		Frequency(N)	Percentage %
Urine- albumin	1+,2+	51	77.27
	3+,4+	15	22.7
Rbcs	Microscopic	20	30.3
	Gross	46	69.7
Pus Cells	<5 /hpf	44	66.7
	>5/hpf	22	33.3
SPCR	0.2-2.0	51	77.27
	>2	15	22.7
24Hr Urinary Protein In Mg/m^2/Hr	4 - 40	51	77.27
	>40	15	22.7

ASLO was noted to be positive in 30 (45.45%) cases. ANA and dsDNA was positive in 9 (13.6%) cases. 65 (98.48%) cases had low C3 level at presentation. Renal biopsy was required in 16 (24.2%) cases.

The most common cause of acute glomerulonephritis in our study was post infectious glomerulonephritis seen in 53 (80.3%) cases followed by Systemic lupus erythematosus seen in 9 (13.6%) cases and MPGN in 3(4.5%) cases and HSP nephritis in 1(1.5%) case.

Out of 66 children, 39 (59%) developed complications. The most common complication observed was acute kidney injury in 17 (25.7%) cases followed by hypertensive encephalopathy in 15 (22.7%) cases. Acute pulmonary edema was seen in only in 7 (10.6%) cases..

Among 66 cases of AGN, 32 (48.5%) cases required antihypertensives, 63(95.4%) cases required diuretics and 3 (4.5%) cases required only diet modification at presentation. 14(21.2%) cases later required additional immunosuppressants.

At 3 months follow up, edema was present in 1 (1.5%) case, microscopic hematuria in 20 (30.8%) cases and macroscopic hematuria in 2 (3.1%) cases. 2(3%) cases had nephrotic range proteinuria and 6 (9%) cases had nephritic range proteinuria. Hypertension was present in 13 (20%) cases, deranged RFT was seen in 2 (3%) cases.

Table 4: Laboratory findings of study population

		Frequency(N)	Percentage %
Blood Urea	>40 mg/dl	16	24.2
Serum Creatinine	Deranged	17	25.7
Serum Cholesterol	>200 mg/dl	12	18.2
Serum Sodium	<130	2	3.0
Serum Potassium	>5.5	8	12.1
ASLO (Todd units)	>200	30	45.45

Serum C3	>75 mg/dl	1	1.5
	<75 mg/dl	65	98.48
ANA	Positive	9	13.6
dsDNA	Positive	9	13.6
USG Kidney	Increased echo-texture	24	36.4
Renal biopsy	Done	16	24.2

12 (18.2%) cases had persistent low C3 level at 3 months follow up. At 6 months, none had edema, macroscopic hematuria, deranged RFT. 4 (6.2%) cases had microscopic hematuria, 2 (3%) cases had nephritic range and 1 (1.5%) case had nephrotic range proteinuria, 8 (12.2%) cases had hypertension.

Table 5: Renal biopsy findings of study population

Etiology		Frequency (N)	Percentage %
PIGN	Diffuse and global endocapillary proliferative glomerulonephritis with 1) Exudates 2) Crescent	 2 1	 3% 1.5%
SLE	Based on ISN/RPS classification: Class III (A) lupus nephritis with full house pattern on IF Class III (A) + Class V lupus nephritis with full house pattern on IF Class IV (A) + Class V lupus nephritis with full house pattern on IF	5 2 2	7.6% 3% 3%
HSP	Mesangial hypercellularity with IgA deposits in mesangium	1	1.5%
MPGN	Double contour glomerular basement membrane with 1) Immune complex mediated glomerulonephritis. 2) Complement dominant glomerulonephritis	 2 1	 1.5% 6.25%

Among 66 children with AGN, 39 (59.1%) children had complete recovery at 3 months and 58 (87.88%) children had complete recovery at 6 months in both clinical and laboratory parameters

Table 6: Complete recovery based on clinical and laboratory parameters at follow up at 3 months and 6 months in the study population

Etiology	Total number of cases N	Complete recovery at 3 months N (%)	Complete recovery at 6 months N(%)
PIGN	53	38 (71.7%)	53(100%)
Lupus nephritis	9	0	3 (33.3%)
MPGN	3	0	1 (33.3%)
HSP nephritis	1	1(100%)	1(100%)
Total AGN cases	66	39(59.1%)	58(87.88%)

Renal biopsy of 16 patients with atypical features were done early in the course of illness and prompt treatment initiated could be the reason most our patients had complete recovery at 6 months follow up.

Early identification, management and long term follow up of AGN helps to treat them appropriately and prevents progression to end stage renal disease and thereby reduces morbidity and mortality.

DISCUSSION:

A total of 66 children with acute glomerulonephritis were enrolled in our study, of which the most common age group was between 6-10 years. Studies conducted by Bhalla et al[1], Agarwalla et al[2], Kamalakarabanu et al[3], Valiyat et al[4], Shah et al[5] also noted AGN cases in similar age group.
Male to female ratio in our study was 1.3:1 showing higher incidence in males than females similar to studies of Bhalla et al[1], Agarwalla et al[2], Kamalakarabanu et al[3] and Valiyat et al[4].
Most of the cases in our study were during rainy and winter season which was found to correlate with study conducted by Bhalla et al[1].
The most common preceding infection in AGN children in our study was Pyoderma which was seen 27 (40.9%) cases which was similar to studies of Agarwalla et al[2] 32(64%) cases, Kamalakarabanu et al[3] 8(19%) cases and Valiyat et al[4] 70(68.9%) cases, however pharyngitis was the most common preceding infection in studies by Bhalla et al[1] 36(70.2%) cases and Shah GS et al[5] 24(25.5%) cases.
In our study the most common presenting compliant was edema seen in 59 (89.4%) cases similar to studies by Valiyat et al[3] 103 (100%) cases, Bhalla et al[1] 49(98%) cases and Shah GS et al[5] 80(85%) cases whereas oliguria 47(94%) cases was the most common presentation in Agarwalla et al[2] and hematuria 21(51%) cases was the most common presentation in Kamalakarabanu et al[3].
At admission in our study population, 57 (86.4%) cases had hypertension similar to studies conducted by Bhalla et al[1] 40(80%) cases, Agarwalla et al[2] 43(86%) cases, Shah GS[5] et al 81(86.2%) cases however study conducted by Valiyat et al[4] had 62 (60.1%) cases with hypertension whereas only 6 (14.3%) cases had hypertension in Kamalakarabanu et al[3] study.
Among 66 children in our study, nephritic range proteinuria was seen in 51(77.27%) cases similar to other studies and nephrotic range proteinuria was seen in 15 (22.7%) cases which correlated with the study conducted by Agarwalla et al[2] 10(20%) cases whereas study conducted by Shah GS et al[5] had 32 (33.9%) cases which was little higher than our study and Kamalakarabanu et al[3] and Valiyat et al[4] studies noted only 2(4.8%) and 10(9.7%) cases respectively in nephrotic range which was little lower than our study.
Hematuria was noted in all 66 (100%) children in our study similar to studies conducted by Agarwalla et al[2] and Kamalakarabanu et al[3].
In our study serum creatinine was deranged in 17(25.7%) cases which was lesser whereas Bhalla et al[1] 38(76%) cases, Agarwalla et al[2] 30(60%) cases, Kamalakarabanu et al[3] 19(45.2%) cases, Shah et al[5] 41(43.6%) cases studies noted higher deranged serum creatinine levels compared to our study. Hyperkalemia was seen 8(12.1%) cases which was similar to other studies.
C3 was low in 65(98.48%) cases which correlated with studies conducted by Bhalla et al[1] 48(96%) cases, Agarwalla et al[2] 41(83%) cases, Valiyat et al[4] 85(82.5%)cases except study conducted by Kamalakarabanu et al[3] which noted 19 (45.2%) cases with low C3 level as the second most common cause of AGN in their study was drug induced nephropathy.
ASLO was positive in 30(45.45%) cases in our study which correlated with study of Valiyat et al[4] 51(50%) cases whereas studies by Agarwalla et al[2] 19 (38%) cases, Shah et al[5] 32(34%) cases found little lower ASLO positivity compared to our study. However 46 (92%) cases had positive ASLO in Bhalla et al[1] study which was much higher compared to our study as history of pharyngitis was predominant in their study.
24 (36.4%) cases had increased cortical echotexture in ultrasound in our study which was little higher compared to Bhalla et al[1] 8(16%) study.
The most common etiology of AGN in our study population was Post infectious glomerulonephritis seen in 53(80.3%) cases similar to studies conducted by Bhalla et al[1] 48(96%), Kamalakarabanu et al[3] 18(42.9%) and Shah et al[5] 79(84%) cases.
The second most common etiology in our study was Systemic lupus erythematosus seen in 9(13.6%) cases similar to Shah et al[5] 10 (10.6%) study whereas in Bhalla et al[1] and Kamalakarabanu et al[3] studies it was HSP 2(4%) and drug induced nephropathy12 (28.6%) cases respectively.
In our study population, at 3 months follow up edema was present in only 3(1.5%) cases while

Valiyat et al[4] noted edema in 6 (5.8%) cases. However no edema was found at 6 months follow up in our study similar to studies conducted by Valiyat et al[4] and Bhalla et al[1].

CONCLUSION:

Children with AGN usually recover within 1-2 weeks and have excellent prognosis, however rapid deterioration of serum creatinine, older age, persistence of abnomalities like proteinuria, hematuria, deranged serum creatinine, hypertension; should alert the pediatrician to consider renal biopsy to look for complicated PIGN with crescents, acute tubular injury and to look for non infectious cause of AGN like SLE, HSP, MPGN, IgA nephropathy, ANCA associated vasculitis. Monitoring and treating cases with persistent proteinuria and hematuria cases should be vigilant to prevent progression to end stage kidney disease. Persistent low C3 is of diagnostic importance and helps to recognize those who need long term follow up for worsening renal parameters. Early detection of complicated PIGN and non infectious cause of AGN helps to treat them appropriately and prevents progression to end stage renal disease and thereby reduces morbidity and mortality. Early identification, monitoring, management and long term follow up minimizes fatal outcome and reduces morbidity and mortality.

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