

Clinico-Epidemiological Study of Children Admitted with Acute Post-Infectious Glomerulonephritis at a Tertiary Care Hospital in Assam, India: A Retrospective Cohort Study

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Abstract

Introduction: Post-infectious glomerulonephritis (PIGN) presents with a sudden onset of hematuria, oliguria, edema and hypertension in children and the severity varies from minimal to life threatening complications like anuria, congestive cardiac failure (CCF) and hypertensive encephalopathy. Among the infection related glomerulonephritis, Post-streptococcal glomerulonephritis (PSGN) is one of the commonest cause in children.

Aim: a) To study the clinico-epidemiological profile in children admitted with PIGN at Tinsukia Medical College & Hospital (TMCH), a tertiary care hospital at Tinsukia, Assam. b) Correlation of clinical and laboratory parameters of children with PIGN and its outcome.

Materials and Methods: A retrospective cohort study was conducted in the Department of Pediatrics at Tinsukia Medical College & Hospital (TMCH) from 1st November, 2024 to 28th February, 2026. Data from 35 children were collected, including demographic details, clinical signs and symptoms and laboratory parameters. All the statistical analysis were performed using Medcalc Version 20.026. The results were expressed as percentages. Test of significance was done by chi-square test. $P < 0.05$ was considered significant.

Results: The most common age group affected was 7-9 years with male predominance 1.69:1. The incidence of glomerulonephritis was more in children coming from lower socio-economic families. The clinical presentations included were oliguria 35 (100%), puffiness of face 33 (94.28%), skin infection 32 (91.42%), pain abdomen 32 (91.42%) and swelling of feet 30 (85.71%). The comparison between incidence of oliguria and blood urea was statistically significant. There was also clinical correlation present between edema and proteinuria. Out of 35 (100%) children, 5 (14.28%) were associated with increased serum creatinine level.

Conclusion: PIGN is a preventable and completely curable disease if precautions such as personal hygiene is well maintained. The main cornerstone for the successful outcome of patients is proper knowledge of pathophysiology of glomerulonephritis thereby institution of appropriate treatment and careful follow up.

Keywords: Acute Glomerulonephritis, Streptococcal Infection, Acute Kidney Injury, Outcome.

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Introduction

Acute glomerulonephritis (AGN) is an immune-mediated disorder characterized by infiltration and proliferation of acute inflammatory cells like mononuclear cells and neutrophils in the glomerulus and accounts for approximately 90% of the renal disorders in children [1].

The onset of symptoms is usually acute with distinct clinical features ranging from asymptomatic hematuria to rapidly progressive glomerulonephritis with acute kidney injury requiring dialysis. It can occur due to non-infectious etiology or following various infections in which it is known as PIGN. Among PIGN, Post-

streptococcal glomerulonephritis (PSGN) is considered to be a major part and one of the leading cause of hospitalization among children particularly in developing countries where streptococcal infections are prevalent [2]. PSGN is a post-infectious sequelae of pharyngitis and skin infection caused by nephritogenic strains of group A beta-hemolytic streptococci [3].

The clinical features developed 1-2 weeks after a sore throat or 2-4 weeks following skin infection. The global incidence of PSGN was estimated to be 4,72,000 cases per year with 4,56,000 occurring in developing countries and 4,04,000 of those cases

occurring in children alone with 97% occurring in low and middle socioeconomic status where overcrowding and poor hygiene persists [4].

The clinical manifestations of PSGN include sudden onset of hematuria and proteinuria in the urine and is often associated with hypertension, edema, azotemia i.e. decreased glomerular filtration rate (GFR), renal salt and water retention [5]. Although, the mortality rate of AGN is low (1%), but sometimes it can lead to serious complications like pulmonary edema, CCF, hypertensive encephalopathy and the most severe renal disorder known as rapidly progressive glomerulonephritis (RPGN), which can lead to end-stage renal failure in a few weeks or months [6]. Moreover, very few studies were reported from developing countries like India.

Keeping this background in mind, the present study was undertaken to determine the demographic, clinical characteristics and laboratory parameters associated with PIGN and their clinical correlation in predicting outcome.

Aim: a) To study the clinico-epidemiological profile in children admitted with PIGN at Tinsukia Medical College & Hospital (TMCH), a tertiary care hospital at Tinsukia, Assam. b) Correlation of clinical and laboratory parameters of children with PIGN and its outcome.

Materials and Methods

Study Population and Settings: This is a retrospective cohort study conducted in the Department of Pediatrics at TMCH, admitted over a period of 16 months. Cases that were admitted from 1st November, 2024 to 28th February, 2026 were collected and analysed from 1st March, 2026 to 30th April. This is a tertiary care center that provides healthcare facilities to the several remote areas of Tinsukia district including nearby areas from Arunachal Pradesh with most patients referred to this hospital due to delay in diagnosis, lack of laboratory and intensive care facilities.

Inclusion Criteria: Children presenting with acute onset of oliguria, edema, hematuria and hypertension at the time of presentation in the absence of alternate diagnosis were included in the study.

Exclusion Criteria: Children presenting with alternate diagnosis like nephrotic syndrome and chronic kidney disease were excluded from the study.

Study Procedure: All the children admitted between this period with a diagnosis of AGN, PIGN or PSGN were identified and their discharge summaries were retrospectively reviewed. Relevant data on clinical, demographic and laboratory parameters were evaluated from the case records and discharged summaries. The gradings of blood pressure was based on normative distribution of BP according to age, sex and height percentile.

Hematuria was defined as 5 red blood cells/high power field on a centrifuged urinary specimen. Proteinuria was defined as subnephrotic proteinuria if 1-2 + on the dipstick and nephrotic proteinuria if >2 or >2+ on the dipstick. A single anti-streptolysin O (ASLO) titre of >200 Todd's unit was considered positive. Acute Kidney injury was defined using AKIN criteria. Hypertensive encephalopathy generalized or posterior reversible encephalopathy syndrome (PRES) is suggested by the presence of headache, vomiting, temperature elevation, visual disturbance, ataxia, and depressed level of consciousness, CT abnormalities and seizures.

Statistical Analysis: All the statistical analysis were performed using statistical software called MedCalc Version 20.026. The results were expressed as percentages. Test of significance was done by chi square test and $P < 0.05$ was considered significant.

Results

A total of 35 cases were included in the present study and the sex and age wise analysis of the cases showed that, only 1 male child was below 3 years. Between 4-6 years, 7-9 years and 10-12 years, the distribution of cases in male children were 2, 12 and 7 cases respectively. In females, age wise distribution of cases showed that between 4-6 years, 7-9 years and 10-12 years were 2, 6 and 5 respectively. The number of cases in males were reported to be more in the age group of 7-9 years. The incidence of glomerulonephritis was 22 in male children and 13 in female children. There is an increase in the incidence of glomerulonephritis in males compared to females. The sex ratio of male to female was reported to be 1.69:1 [Table-1].

Table 1: Age and gender distribution

Age	Male	Female	Total	Percentage
Upto 3 years	0	1	1	2.85
4-6 years	2	2	4	11.42
7-9 years	12	6	18	51.42
10-12 years	7	5	12	34.28
	22	13	35	100

The present study showed that only 3 cases were from high socio- economic status and 32 cases

were from low socio- economic status. Thus, it is quite obvious that the incidence of

glomerulonephritis was more in lower socioeconomic families.

Analysis of seasonal trend showed 14 cases were reported from January to June and 21 cases from July to December comprising of 40% and 60% respectively. This showed that cases were more common in rainy and winter season. The common clinical presentations were oliguria, HTN, puffiness of face, skin infections, pain abdomen, swelling of

the feet, macroscopic hematuria, ascites, CCF, vomiting, hepatomegaly, breathlessness and headache comprising of 35 (100%), 35 (100%), 33 (94.28%), 32 (91.42%), 30 (85.71%), 28 (80%), 26 (74.28%), 6 (17.14%), 5 (14.28%), 4 (11.2%), 3 (8.57%) and 2 (5.71%) respectively.

Severe life- threatening complications like altered sensorium and seizures were not reported in the present study [Table -2].

Table 2: Clinical features

Presenting symptoms	No. of cases	Percentage
Oliguria	35	100
HTN	35	100
Puffiness of the face	33	94.28
Skin infections	32	91.42
Pain abdomen	32	91.42
Swelling of the feet	30	85.71
Macroscopic hematuria (cola colored urine)	28	80
Ascites	26	74.28
CCF	6	17.14
Vomiting	5	14.28
Hepatomegaly	4	11.42
Breathlessness	3	8.57
Headache	2	5.71
Altered sensorium and seizures	0	0

From the gender wise analysis of hypertension, it was observed that the incidence of hypertension was more common in male than female children comprising of 23 (65.71%) and 12 (34.28%) respectively [Table 3].

Table 3: Gender wise distribution of children associated with hyperextension

Blood pressure	Male	Female
Elevated	3	2
Stage 1 HTN	16	9
Stage 2 HTN	4	1
	23	12

Laboratory evaluation of 35 children affected with glomerulonephritis showed that hematuria was observed in all the cases whereas proteinuria ranging from 1+ to 3+ reported in 31 cases in which 1+, 2+ and 3+ proteinuria seen in 2(5.71%), 17 (48.57%) and 12 (34.28%) children respectively [Table-4].

Table 4: Urine examination

Urine routine examination	No. of cases	Percentage
1+ proteinuria	2	5.71
2+proteinuria	17	48.57
3+ proteinuria	12	34.28
Hematuria	33	94

Laboratory parameters: The blood urea of children affected with glomerulonephritis showed that below 40 mg/dl in 26 (74.28%) and above 40 mg/dl in 9 (25.71%) respectively [Table-5].

Table 5: Blood urea

Blood urea	No. of cases	Percentage
20-40 mg/dl	26	74.28
40-80 mg/dl	7	20
80-100 mg/dl	2	5.71

Estimation of serum creatinine below 1 mg/ dl reported in 30 (85.71%) and above 1mg/ dl reported in 5 (14.28%) cases [Table-6].

Table 6: Serum creatinine

Serum creatinine	No. of cases	Percentage
<1mg/dl	30	85.71
1-2 mg/dl	3	8.57
2-4 mg/dl	2	5.71

The abnormal serum sodium i.e. level less than 130 mmol/L was reported in 6 (17.14%) and above 145 mmol/L was seen in 2 (5.71) cases respectively [Table-7].

Table 7: Serum sodium

Serum Sodium	No. of cases	Percentage
<130 mmol/L	6	17.14
130-145 mmol/L	27	77.14
>145 mmol/L	2	5.71

In this study, the serum potassium of 3 children was below 3 mmol/L (8.57%) and 4 children above 5.5 mmol / L (11.42%) respectively [Table- 8].

Table 8: Serum potassium

Serum Potassium	No. of cases	Percentage
<3 mmol/ L	3	8.57
3-3.5 mmol/L	28	80
>5.5 mmol/L	4	11.42

The incidence of oliguria and raised blood urea were 35 (100%) and 9 (25.71%) respectively. The comparison between incidence of oliguria and raised blood urea found to be statistically significant with P value of <0.0001 [Table-9].

Table 9: correlation of blood urea and oliguria

	Present	Absent	p-value
Oliguria	35 (100%)	0	<0.0001
Blood urea	9(25.71%)	26 (74.28%)	

Correlation of edema and proteinuria: The most common clinical presentation in the present study are oliguria and proteinuria comprising of 35 (100%) and 31(88.57%) respectively. Almost all

the children of proteinuria were associated with edema. Therefore, the clinical correlation found to be statistically significant with P-value of 0.04 [Table -10].

Table 10: Correlation of edema and proteinuria

	Present	Absent	p-value
Edema	35 (100%)	0	0.04
Proteinuria	31(88.57%)	4 (11.42%)	

The incidence of oliguria and raised serum creatinine were 35 (100%) and 5 (14.28%). It was observed that less than 1/4th children with oliguria were associated with increased serum creatinine which is found to be statistically significant with the P value of <0.0001 [Table- 11].

Table 11: Correlation of oliguria and serum creatinine

	Present	Absent	p - value
Oliguria	35 (100%)	0	<0.0001
Serum creatinine	5 (14.28)	30 (85.71)	

Estimation of serum protein level was normal in all the children with AGN.

Antecedent infection: This study showed that 32 children had clinical (healed or active) pyoderma. However, there was no case reported with antecedent sore throat. On estimation of ASO titer it was found to be raised in 32 children indicating that the glomerulonephritis might be due to post-streptococcal infection comprising of 91.42%. Only

3 cases showed negative ASO titer comprising of 8.57%, hence classified into unconfirmed etiology. Evaluation of complements in the blood showed that the level was low in 34 children and normal in 1 child comprising of 97.14% and 2.85% respectively.

Radiological Changes: Evaluation of by X-ray revealed cardiomegaly in 4 (11.42%), pleural effusion in 1 (2.85%) and pneumonitis in 2 (5.71%) children respectively [Table: 12].

Table 12: Chest X ray

CXR	No. of cases	Percentage
Normal cardiac size with prominent lung vasculature	28	80
Cardiomegaly	4	11.42
Pleural effusion	1	2.85
Pneumonitis	2	5.71

Evaluation of ultrasound examination of the abdomen revealed that bulky kidneys were observed in 19 (54.28%), increased echotexture in 11(31.42%) and pleural effusion with ascitis in 1(2.85%) children respectively [Table-13].

Table 13: USG whole abdomen findings

USG whole abdomen	No. of cases	Percentage
Normal study	4	11.42
Bulky kidneys with decreased echotexture	19	54.28
Increased echotexture	11	31.42
Pleural effusion with ascites	1	2.85

Complications of acute glomerulonephritis in children: Out of 35 children, 11 presented with complications associated with AGN. The incidence of Congestive Cardiac Failure (CCF) and AKI were 6 (17.14%) and 5(14.28%) respectively [Table-14].

Table 14: Complications

Complications	Frequency
Congestive Cardiac Failure	6 (17.14%)
Acute Kidney Injury	5 (14.28%)
Hypertensive Emergency	0 (0.0%)
Mortality	0 (0.0%)

Outcome: All the children were successfully discharged meeting unit policy for the dischargeable criteria with zero mortality. According to unit policy, children were discharged if they were no longer oliguric, blood pressure within normal range, gross hematuria had resolved and serum creatinine had reached baseline.

Table 15:

	No. of cases	Percentages
Discharged successfully	35	100
Death	0	0

Discussions

Incidence of Disease: 1278 cases were admitted in the department of Pediatrics over a period of 16 months and out of which 35 children were diagnosed with PIGN in which majority of them were identified as PSGN. Although PIGN dominated the clinical profile in this study, other non- post streptococcal glomerulonephritis etiologies should also be recognized. Gunasekaran et al from Southern India have made similar observations where 90% of PIGN documented clinic- serological evidence of streptococcal infection [7].

Sex Distribution: The present study revealed that PIGN is more common in male children with male to female ratio 1.69:1. This is similar to the studies done by Tizki S et al., and Gunakesaran K et al., [6,7]. Thus, it is concluded that there is slight male preponderance in all the studies including the present study.

Age Distribution: The present study reported that maximum number of cases were seen between 7-9 years of age comprising of 51.42% and a smaller

number of cases were seen below 5 years and above 10 years comprising of 14.28% and 34.28% respectively. PSGN in very young children is attributed to immature immune response. These observations are in accordance with the study reported by Gunakesaran et al., [7].

Socioeconomic Group: Out of 35 cases, 32 (91.42%) children were from lower socioeconomic status. Similar findings were also showed by Kondapalli C et al., and Etuk et al., with reported incidence comprising of 96% and 82% respectively [1,8]. Therefore, the incidence of glomerulonephritis is found to be more common in children of lower socio-economic status because of repeated sore throat and skin infection.

Seasonal Trend: The present study showed clustering of cases from July to December and similar findings were also reported from Kondapalli C et al., [1]. Thus, it was concluded that most of the cases of AGN occur in rainy and winter season.

Clinical presentations: Out of 35 children, the most common clinical features were oliguria followed by

puffiness of the face, pain abdomen, swelling of the feet and cola coloured urine comprising of 35(100%), 33 (94.28%), 32 (91.42%), 32 (91.42%) 30 (85.71%) and 28(80%) respectively. These findings are consistent with the studies done by Agarwalla S et al., in which the common clinical features were oliguria, puffiness of face, pedal edema and gross hematuria comprising of 47 (94%), 42 (84%), 32 (64%) and 32 (64%) respectively [8]. In the present study, hypertension was reported in all the 35 (100%) cases which is found to be similar to the study done by Jiya et al., (90.2%) [9].

Preceding Infection: The percentage of skin infection in the present study was very high 32 (91.42%) and similar results were also observed from Agarwalla S K et al., however the percentage of skin infection is less as observed by Baroi et al., [5,8]

Laboratory Investigations: The incidence of proteinuria in the present study was 31 (88.75%) which is comparable with the studies done before by Megil et al., and Yadav et al., [10,11]. Evaluation of hematuria from the present study was 94% which is comparable with the other studies like Kondapalli et al., Tizki et al., and Adhikari et al., [1,6,12] The present study reported that the incidence of raised blood urea was 9(25.71%). Similar finding was reported from the study done by Bhuiyan et al., [13] The incidence of increased serum creatinine from the present study was 14.28% and it is comparable with the studies like Calabar et al and Bhuiyan et al [13,14] Radiological appearance of the chest: The present study reported that the incidence of cardiomegaly, pleural effusion and pneumonitis were 4 (11.42%), 1 (2.85%) and 2 (5.71%) respectively. In majority of the children, there were no secondary effects of glomerulonephritis with normal chest X-ray.

USG abdomen: USG evaluation revealed that bulky kidneys were observed in 19 (54.28%) children. On estimation of ASLO titer, it was observed that, in the present study 31(88.57%) cases presented with raised ASLO titer which indicates that the development of glomerulonephritis might be due to group A beta hemolytic streptococci and associated mostly with pyoderma. This is similar with the study done earlier by Akteruzzaman et al.,[15]. Evaluation of electrolytes mainly sodium and potassium from the present study revealed hyponatremia and hyperkalemia 17.14% and 11.42% respectively. In the present study, the common complications associated with PIGN are congestive cardiac failure (CCF) and AKI comprising of 6 (17.14%) and 5 (14.28%) which emphasizes the need for regular monitoring in these children in order to decrease morbidities. It has been reported that the children

developing AKI following AGN may have long term residual renal injury [12].

However, cases were not followed up in this study. All the cases were managed symptomatically and had favourable outcome and were discharged successfully from the hospital.

Limitations: The limitation of our study is its retrospective study design and small sample size which limited the amount of clinical data to be collected.

Also, asymptomatic and minimally symptomatic PIGN might have missed out. The study was conducted in a tertiary care centre and the results may not be representative of the disease encountered in general population. The work up of other causes of AGN like connective tissue disorders and IgA nephropathy were not done during the study.

Conclusion

The present study highlights the ongoing public health significance of this condition, particularly in developing countries. It emphasizes on the importance of recognizing clinical features of PIGN and post-streptococcal nephritis such as swelling of face and limbs, oliguria, hematuria and hypertension supported by diagnostic markers like raised ASO titer and low serum C3 levels. Despite the potential for life threatening complications like CCF and hypertensive encephalopathy, early diagnosis and institution of proper management yield favourable outcome with zero mortality in this study. Therefore, there is a need for ongoing surveillance, prevention strategies, and effective management protocols to address this burden effectively.

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