

ORIGINAL RESEARCH ARTICLE

ACUTE GLOMERULONEPHRITIS IN CHILDREN: A HOSPITAL-BASED STUDY IN A TERTIARY CARE CENTRE IN NEPAL

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**ABSTRACT**

**Background:** Acute glomerulonephritis is a common pediatric kidney disease which places a huge burden in developing countries. This study aimed to evaluate causes, clinical manifestations, laboratory findings and complications of acute glomerulonephritis in children presented to a tertiary care center of Nepal.

**Methods:** This was a retrospective review of records of children admitted with acute glomerulonephritis at Chitwan Medical College from April 2018 to February 2021. Socio-demographic data, clinic-laboratory profile and outcomes were obtained from medical records and descriptive analysis was carried out.

**Results:** Among 48 recruited children with acute glomerulonephritis, 60.4% were male and the mean age was  $9.5 \pm 3.7$  years. Post infectious glomerulonephritis including post streptococcal glomerulonephritis (48%) was the main cause of acute glomerulonephritis. The major clinical features were edema (81.3%), hypertension (72.9%), dyspnea (29.2%) and hematuria (25%). ASO titer was positive in 45.8%. The complications noted were acute kidney injury (6.3%), hypertensive emergency (6.3%) and congestive cardiac failure (2.1%).

**Conclusions:** Most of the patients were above 5 years of age and presented most commonly during autumn and summer season. The complications of acute glomerulonephritis were acute kidney injury, hypertensive emergency and congestive cardiac failure.



**INTRODUCTION**

Acute glomerulonephritis comprises of all those glomerular diseases that present with acute nephritic syndrome and are characterized by hematuria, edema, hypertension and evidence of renal insufficiency (elevated blood urea and creatinine).<sup>1,2</sup> Post-infectious glomerulonephritis (PIGN) is the commonest cause of acute glomerulonephritis among children.<sup>3</sup> Its global incidence has been estimated to be 472,000 per year, 97% of which occurring in developing nations.<sup>3,4</sup> The most common cause of PIGN in children is post-streptococcal glomerulonephritis (PSGN) which usually appears in children between 5 and 12 years.<sup>2</sup> Congestive heart failure, pulmonary edema, hypertensive emergency and acute kidney injury (AKI) have been reported as common complications in the acute stage of glomerulonephritis.<sup>5</sup>

A number of studies have already been reported in Nepal on acute glomerulonephritis in children, one of which reported that acute glomerulonephritis comprised 3.1% of annual pediatric admissions.<sup>6-8</sup> The aim of this study was to explore the clinico-laboratory features and complications of acute

glomerulonephritis among paediatric patients in Chitwan Medical College Teaching Hospital, Chitwan.

**METHODS**

We performed a retrospective review of children who presented to the Department of Pediatrics, Chitwan Medical College Teaching Hospital with the final diagnosis of acute glomerulonephritis from 1<sup>st</sup> April 2018 to 28<sup>th</sup> February 2021. Ethical approval was taken from Institutional Review Committee. Pediatric patients diagnosed with different types of acute glomerulonephritis were identified through the medical records in the hospital. The convenience sampling technique was used and all the pediatric patients diagnosed with acute glomerulonephritis were included in our study. Children with other renal diseases like urinary tract infection, renal stones and anatomical lesions of urogenital tract were excluded from the study. The patients were managed as per the institutional protocol.

Information on socio-demographics, clinical features, laboratory findings, treatment and complications were

collected in a predesigned proforma. Acute nephritic syndrome was defined as acute onset of clinical symptoms; edema, hypertension, hematuria and oliguria with or without evidence of elevated blood urea and creatinine. Post infectious glomerulonephritis was defined as features of acute nephritic syndrome and presence of infectious etiology e.g., pyoderma, pharyngitis, pneumonia or undetermined infection. Acute post streptococcal glomerulonephritis (PSGN) was diagnosed on the basis of clinical features of acute nephritic syndrome along with serological evidence of recent streptococcal infection (recent pyoderma or pharyngitis with positive ASO titers and low serum complement 3 (C3) levels. Acute kidney injury (AKI) was defined as per the pediatric KDIGO criteria i.e., elevation in serum creatinine levels and/or decreased in urine output. Oliguria was defined as urine output less than 0.5ml/kg/hour for at least 12 hours and hematuria was defined as 5 red blood cells per high power field on a centrifuged urine sample. Hypertension was defined as systolic and/or diastolic pressure values exceeding the 95<sup>th</sup> centile for age, sex and height.

Statistical Package for Social Sciences (SPSS) version 20.0 was used for data entry and analysis. Descriptive statistics were used. Categorical variables were expressed as frequencies and percentage (%). Normality of the data was assessed by the Shapiro-Wilk Test. Normally distributed scale variables were presented as mean  $\pm$  SD while non normally distributed variables were expressed as medians and ranges.

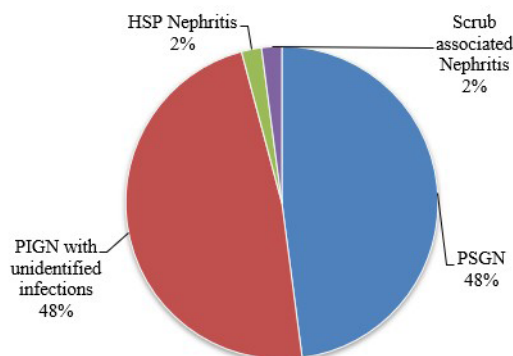
## RESULTS

A total of 48 patients were identified with acute glomerulonephritis during the study period. Mean age of the patients was 9.5  $\pm$  3.72 years, with age ranging from 2 years to 14 years. Majority of them (60.4%) were male. About two-third (64.6%) of the children were residents of rural areas. Most of the cases of acute glomerulonephritis were admitted during autumn season (54.2%) followed by summer (18.8%) (Table 1).

**Table 1: Socio-demographic profile of children with acute glomerulonephritis**

Characteristics	Frequency (%)
<b>Age (years)</b>	
<5 years	8 (16.7%)
>5 years	40 (83.3%)
Mean Age $\pm$ SD (years)	9.5 $\pm$ 3.72
Range (years)	2-14
<b>Sex</b>	
Male	29 (60.4%)
Female	19 (39.6%)
<b>Address</b>	
Rural	31 (64.6%)
Urban	17 (35.4%)
<b>Time of Admission</b>	
Spring	5 (10.4%)
Autumn	26 (54.2%)
Winter	8 (16.7%)
Summer	9 (18.8%)

The most common etiology of acute glomerulonephritis was PIGN including PSGN (48%), scrub associated glomerulonephritis (2%) and undetermined infections (48%) (Figure 1).



**Figure 1: Etiology of acute glomerulonephritis**

The major clinical features at the time of presentation were edema (81.3%) followed by hypertension (72.9%). History of pyoderma and sore throat was present in 6 (12.5%) and 5 (10.4%) of cases respectively (Table 2).

**Table 2: Clinical features of children with acute glomerulonephritis**

Signs/Symptoms	Frequency (%)
Edema	39 (81.3%)
Hypertension	35 (72.9%)
Dyspnea	14 (29.2%)
Gross hematuria	12 (25%)
Fever	12 (25%)
Cough	11 (22.9%)
Oliguria	3 (6.3%)
Pain abdomen	2 (4.2%)
Headache	1 (2.1%)
Seizure	1 (2.1%)

**Table 3: Biochemical profile of children with acute glomerulonephritis**

Laboratory Measures	Frequency (%)
Hematuria	39 (81.25%)
Proteinuria	30 (62.5%)
Elevated ASO titer (>200)	22 (45.8%)
Serum Urea level (mg/dl) *	35.5 (5.5-87.0)
Elevated serum urea	30 (62.5%)
Serum Creatinine level (mg/dl) *	0.64 (0.01-2.07)
Elevated serum creatinine	3 (6.3%)
Serum Complement C3 (mg/dl), *	0.28 (0.10-0.97)
Low Complement (C3)	35 (72.9%)

\*Median values and range of these continuous variables are shown.

In urine analysis, 81.25% patients had hematuria and 62.5% had proteinuria (including sub nephrotic and nephrotic range proteinuria). ASO titer was elevated in 22 (45.8%) patients. Elevated serum urea and creatinine were found in 62.5% and 6.3% children respectively. Almost three fourth cases (72.9%) had decreased serum complement 3 (C3) levels (Table 3).

Out of 48 patients, 7 (14.6%) developed complications. The complications noted were acute kidney Injury (3, 6.3%), hypertensive emergency (3, 6.3%) and congestive cardiac failure (1, 2.1%) (Table 4). All the children had favorable acute outcome and were discharged from the hospital.

**Table 4: Complications of acute glomerulonephritis in children**

Complications	Frequency (%)
Acute Kidney Injury	3 (6.3%)
Hypertensive Emergency	3 (6.3%)
Congestive Cardiac Failure	1 (2.1%)
Mortality	0 (0.0%)

## DISCUSSION

Out of 48 pediatric patients presenting with acute glomerulonephritis, 98% were PIGN including PSGN (48%), scrub typhus associated acute nephritis (2%) and other unidentified infectious etiology (48%). Although PSGN dominated the clinical profile of cases diagnosed as PIGN, infectious etiologies other than PSGN such as scrub typhus and largely unidentified infections were encountered in almost half children. It emphasizes the need to identify the other infectious etiology of acute nephritic syndrome. In a study conducted in South India, 90.3% cases out of PIGN were PSGN and other causes of PIGN were liver abscess (1.4%), pneumonia (5.6%) and mumps (2.8%).<sup>9</sup> A previous study from Nepal reported 84% PIGN out of total cases of acute glomerulonephritis including 34% PSGN, 3.1% mumps nephritis and unidentified infectious etiology in remaining cases.<sup>7</sup>

The mean age of patients presenting with acute glomerulonephritis was 9.5 years with 83.3% above 5 years of age. These observations were in accordance with the other studies where the majority of cases belong to the age group above 5 years.<sup>7,9,10</sup> The low rate of glomerulonephritis in a very early age has been attributed to the immature immune response in early age.<sup>2,11</sup>

More than half of the patients (60.4%) were male which was similar to the findings of previous studies,<sup>1,6,12</sup> However, in a study reported from Nepal by Shah et al, just over a half (52.12%) of the patients were female.<sup>7</sup>

In this study, pyoderma was more frequently associated with acute glomerulonephritis than pharyngitis. Similar findings were reported by Gunasekaran et al, Poudel et al, Shah et al and Ge et al.<sup>6,8,9,13</sup> However, some other studies have reported pharyngitis as a more frequent association than pyoderma.<sup>7,12</sup>

Laboratory investigations showed low levels of complement C3 in most (72.9%) of the patients. Dagan et al. suggested that low C3 is hallmark of PIGN and patients with nephritic syndrome had significantly lower C3 level compare without nephritic syndrome.<sup>3</sup> Even though 98% of the patients had infectious etiology in this study, about 28% had normal C3 level. C3 was sent on the day of admission of each patient which may vary the day from disease onset as each of the patients may present to hospital in different durations from the day of onset of disease. As the level of C3 normalizes after 6-8 weeks of onset, the date from disease onset when C3 is tested might be reason for the normal C3 level. Only 45.8% of children had an elevated ASO titer. Similar kind of findings was reported by a previous study from Nepal.<sup>6</sup> The reasons for normal ASO titer in the majority of patients might be due to antecedent non-streptococcal infections and most of the patients of PSGN were pyoderma related. Utility of ASO titre is low as marker of acute glomerulonephritis following pyoderma. In comparison to ASO titre, streptozyme test to include anti-DNAse B is a preferable test for post-pyoderma PSGN.<sup>14-16</sup> Anti-DNAse B test could not be done in our setting due to unavailability.

The most common complications encountered in patients with acute glomerulonephritis were acute kidney injury (AKI), hypertensive emergency and congestive cardiac failure. These complications emphasize the need for regular monitoring in these children in order to limit the morbidities. It has been reported that children with PIGN developing AKI may have long term residual renal injury.<sup>9,17</sup> However, we couldn't get any clinical data regarding the follow up. All the cases were managed symptomatically and all the available supportive measures were provided. All the children had favorable acute outcome and were discharged from the hospital.

The limitation of our study is its retrospective study design which limited the amount of clinical data to be collected. It was conducted in a tertiary care centre and the findings may not be representative of the disease profile encountered at community level. Furthermore, work up for other non-infectious causes of AGN like connective tissue disorders and IgA nephropathy was not done during the study.

## CONCLUSION

Most of the patients were above 5 years of age and presented most commonly during autumn and summer season. The relatively lower percentage of patients with elevated levels of ASO titer emphasizes the utility of anti-DNAse B tests in patients with acute nephritic syndrome following pyoderma. There were complications like AKI, hypertensive emergency and congestive cardiac failure which emphasize the need for follow up and regular monitoring of these patients to avoid residual morbidities.

**CONFLICT OF INTEREST:** None

**FINANCIAL DISCLOSURE:** None

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