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Clinical Manifestations and Outcomes of Acute Post-Streptococcal Glomerulonephritis in Hospitalized Children Under 12 Years at a Tertiary Care Hospital

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ABSTRACT

Background: Acute post-streptococcal glomerulonephritis (APSGN) is a common immune-mediated renal disease in children, often following throat or skin infections with nephritogenic strains of Group A β-haemolytic Streptococcus. While the condition is frequently self-limiting, severe cases can result in acute kidney injury (AKI) and long-term morbidity. Limited data exist on the clinical profile and outcomes of APSGN in children under 12 years in Pakistan. **Objectives:** To describe the clinical manifestations of APSGN in hospitalized children under 12 years and to evaluate their outcomes during hospital stay and at three-month follow-up. **Methods:** This cross-sectional study was conducted in the Pediatric Department of Bacha Khan Medical Complex, Swabi, Pakistan, over six months. A total of 110 children under 12 years with APSGN were included using consecutive sampling. Data on demographics, antecedent infections, clinical and laboratory features, management, and outcomes were collected prospectively. Descriptive statistics were used for frequencies and percentages, while Chi-square/Fisher's exact test assessed associations with outcomes. A p-value ≤0.05 was considered statistically significant. **Results:** Among 110 patients, 56.4% were male, and 55.5% belonged to low socioeconomic backgrounds. A history of sore throat preceded illness in 72.7% of cases, while skin infection was noted in 17.3%. Common clinical features included edema (83.6%), hematuria (87.2%; gross 62.7%, microscopic 24.5%), hypertension (56.4%), proteinuria (63.6%), oliguria (31.8%), and AKI (14.5%). Treatment comprised supportive care (32.7%), diuretics (25.5%), antihypertensives (35.5%), and dialysis (6.4%). At discharge, 64.5% had recovered and 35.5% had residual renal abnormalities. At three months, 91.8% achieved complete recovery, while 8.2% showed persistent abnormalities. AKI (p=0.00) and dialysis requirement (p=0.034) were significantly associated with poor outcomes. **Conclusion:** APSGN in children under 12 years was more common in males and those from low socioeconomic backgrounds, predominantly following sore throat infections. Most children achieved full recovery within three months; however, AKI and dialysis were predictors of adverse outcomes. Early recognition and close follow-up of high-risk patients remain essential for improving long-term prognosis.

INTRODUCTION

Acute post-streptococcal glomerulonephritis (APSGN) is an immune-mediated glomerular disease that typically follows infection with nephritogenic strains of Group A β-haemolytic Streptococcus (GAS), arising from throat or skin sources. It usually presents in children with manifestations such as hematuria, edema, hypertension, oliguria, and sometimes acute kidney injury (AKI). The latency period is typically 1–2 weeks after pharyngitis and 3–6 weeks after skin infection.

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In developing countries, APSGN remains a significant cause of pediatric hospitalization, frequently associated with poor socioeconomic conditions, overcrowding, poor hygiene, and limited access to medical care. The disease course is usually benign in the majority of children, but

some develop complications or residual renal dysfunction(2). Early recognition and management are essential for improving outcomes.

A recent narrative review from Nepal reported that APSGN is the leading cause of acute glomerulonephritis in Nepali children, presenting most often with edema, gross hematuria, hypertension, and oliguria. Complications included acute kidney injury, although most children recovered fully, with persistent issues being uncommon(3).

In Turkey, a decade-long observational study demonstrated that decreased glomerular filtration rate, low complement C3, and elevated inflammatory markers were associated with longer hospitalization in children with APSGN(4). Similarly, Ong et al. highlighted that supportive care—including diuretics, antihypertensives, and fluid restriction—remains the cornerstone of management, while severe cases requiring dialysis are rare but clinically significant(5).

A review from South Asia emphasized that APSGN is still prevalent across low- and middle-income countries where streptococcal infections remain common(6). A cross-sectional study from Indonesia identified that the majority of affected children presented with edema and hematuria, while a smaller subset developed acute kidney injury(7).

In Pakistan, Raza et al. studied APSGN in children up to 16 years of age, reporting a male predominance and high frequency of hypertension and edema at presentation. Sore throat was more commonly reported than skin infection as the antecedent condition(8). In Kashmir, a recent study in 2024 described hypertension, edema, and hematuria as the leading features in affected children, further underscoring the similarity of presentation across South Asian populations(1).

However, there is limited research specifically focusing on children under 12 years of age in tertiary care hospitals in Pakistan, and few studies report outcomes at follow-up, highlighting the need for the present study.

Objectives

1. To describe the clinical manifestations of APSGN in hospitalized children under 12 years in a tertiary care hospital.
2. To determine the outcomes of APSGN during hospital stay, including recovery of renal function, resolution of hypertension, proteinuria, hematuria and to identify factors associated with adverse outcomes.

Operational Definitions

1. APSGN: A clinical diagnosis in children with recent (within 1–6 weeks) Group A streptococcal infection (throat or skin) plus evidence of nephritic syndrome (hematuria, edema, hypertension, oliguria) and laboratory support (elevated ASO/anti-DNase B, low C3)(9).
2. Gross Hematuria: Visible blood in urine as reported by caregivers.
3. Microscopic Hematuria: ≥5 red blood cells per high power field on urine microscopy(9) .
4. Oliguria: Urine output <0.5 ml/kg/hr or markedly reduced from baseline (9).
5. Hypertension: Blood pressure ≥95th percentile for age, sex, and height(9).
6. Acute Kidney Injury (AKI): Increase in serum creatinine ≥1.5× baseline as per KDIGO pediatric criteria(9).
7. Complete Recovery: Normalization of serum creatinine/eGFR, blood pressure, hematuria, and proteinuria by 3 months(9).
8. Adverse Outcome: Persistence of renal dysfunction, hypertension, hematuria, proteinuria, or death by discharge or 3-month follow-up(3, 10).

MATERIALS AND METHODS

Study Design: Cross-Sectional study.

Study Setting: The study was conducted in the Pediatric Department of a tertiary care hospital in Bacha Khan Medical Complex, Swabi, Pakistan

Department of Paediatrics, with nephrology services and outpatient follow-up facilities.

Study Duration: The study spanned 6 months, beginning after ethical approval.

Study Population; Children under 12 years of age admitted with APSGN were enrolled.

Sample Size: Based on an anticipated frequency of persistent renal involvement of 6.5%(10), with a 95% confidence level and 5% margin of error, the calculated sample size was 94. To account for non-response, the final sample size was set at 110 children.

Sampling Technique: Non-Probability Consecutive Sampling

Inclusion Criteria

- Children <12 years admitted with APSGN (defined as nephritic syndrome following streptococcal infection, supported by serology/complement studies).
- Caregiver consent for participation and follow-up.

Exclusion Criteria

- Pre-existing chronic kidney disease.
- Glomerulonephritis due to non-streptococcal causes (e.g., lupus nephritis, IgA nephropathy).
- Incomplete medical records.
- Age ≥12 years.

Data Collection

Data were collected prospectively using a structured questionnaire. Demographics (age, sex, socioeconomic status), antecedent infections (sore throat, skin infection), and interval between infection and symptom onset were recorded. Clinical features at admission included edema, type of hematuria, hypertension, and oliguria. Laboratory parameters were assessed for acute kidney injury and proteinuria. Treatment details (supportive care, diuretics, antihypertensives, dialysis) and hospital stay duration were documented. Outcomes were assessed at discharge (complete recovery, residual renal abnormalities, or death) and at 3 months (complete recovery or persistent abnormality). Follow-up data were obtained in outpatient clinics to ensure consistency.

Data Analysis

Data were analyzed using SPSS version 27. Descriptive statistics were applied: frequencies and percentages for categorical variables, and means ± standard deviation or medians with interquartile ranges for continuous variables (depending on normality assessed by Shapiro-

Wilk test). Associations between independent variables and outcomes were assessed using Chi-square or Fisher's exact tests. A p-value ≤0.05 was considered statistically significant, with 95% confidence intervals reported.

RESULTS

Among 110 children included in the study, 62 (56.4%) were male and 48 (43.6%) were female. The majority belonged to low socioeconomic status (55.5%), followed by middle (37.3%) and high (7.3%) classes. A history of sore throat was present in 80 (72.7%) patients, while 19 (17.3%) had skin infections. Clinical features included edema in 92 (83.6%), hematuria in 96 (87.2%)—with gross hematuria in 69 (62.7%) and microscopic in 27 (24.5%)—and hypertension in 62 (56.4%). Oliguria was observed in 35 (31.8%) patients, acute kidney injury in 16 (14.5%), and proteinuria in 70 (63.6%). Treatment modalities included supportive care alone in 36 (32.7%), diuretics in 28 (25.5%), antihypertensives in 39 (35.5%), and dialysis in 7 (6.4%). At discharge, 71 (64.5%) recovered, while 39 (35.5%) had residual renal issues. At 3 months, 101 (91.8%) had complete recovery, with only 9 (8.2%) showing persistent abnormalities. (Table 1)

Table 1

Demographics and Clinical Features

		Frequency (n=110)	Percentage (%)
Gender	Male	62	56.4
	Female	48	43.6
Socioeconomic status	Low	61	55.5
	Middle	41	37.3
	High	8	7.3
Sore throat	Yes	80	72.7
	No	30	27.3
Skin Infection	Yes	19	17.3
	No	91	82.7
Edema	Yes	92	83.6
	No	18	16.4
Hematuria	Gross	69	62.7
	Microscopic	27	24.5
	Absent	14	12.7
Hypertension	Yes	62	56.4
	No	48	43.6
Oliguria	Yes	35	31.8
	No	75	68.2
Acute Kidney Injury	Yes	16	14.5
	No	94	85.5
Proteinuria	Present	70	63.6
	Absent	40	36.4
Treatment given	Supportive only	36	32.7
	Diuretics	28	25.5
	Antihypertensives	39	35.5
	Dialysis	7	6.4
Outcome at discharge	Recovered	71	64.5
	Residual Renal Issues	39	35.5
Outcome at 3 months follow-up	Complete Recovery	101	91.8
	Persistent Abnormality	9	8.2

The median age of children was 7 years with an interquartile range (IQR) of 5. The median time from infection to onset of symptoms was 2 weeks (IQR = 1). The median duration of hospitalization was 6 days (IQR = 3). Shapiro-Wilk tests indicated non-normal distribution for age, symptom duration, and hospital stay ($p < 0.05$). (Table 2)

Table 2

Age, Disease Duration and Hospital Stay

	Median	IQR	Shapiro-Wilk P-Value
Weeks to symptoms	2.00	1	.001
Age (years)	7.00	5	.001
Length of hospital stay (days)	6.00	3	
Age (years)	7.00	5	.001
Length of hospital stay (days)	6.00	3	

At discharge, there was no statistically significant association between recovery or residual renal issues and gender, preceding sore throat, skin infection, edema, hematuria, hypertension, oliguria, or proteinuria. Acute kidney injury showed a near-significant trend ($p = 0.06$) toward residual issues. Treatment modalities also did not show strong associations, though supportive-only management had a borderline difference ($p = 0.099$). Overall, most clinical features were not predictive of short-term outcome at discharge. (Table 3)

Table 3

Chi2/ Fischer Exact Test Associations of Clinical Features and Short Term Outcome

		Outcome at Discharge		Chi²/Fischer's Exact P-value
		Recovered	Residual Renal Issues	
Gender	Male	36	26	0.106
	Female	35	13	
Sore throat	Yes	51	29	0.776
	No	20	10	
Skin Infection	Yes	12	7	0.889
	No	59	32	
Edema	Yes	59	33	0.837
	No	12	6	
Hematuria	Gross	44	25	0.460
	Microscopic	16	11	
	Absent	11	3	
Hypertension	Yes	38	24	0.417
	No	33	15	
Oliguria	Yes	19	16	0.139
	No	52	23	
Acute Kidney Injury	Yes	7	9	0.06
	No	64	30	
Proteinuria	Present	47	23	0.451
	Absent	24	16	
Treatment given	Supportive only	28	8	0.099
	Diuretics	19	9	
	Antihypertensives	21	18	
	Dialysis	3	4	

At 3 months' follow-up, most variables—including sore throat, skin infection, edema, hematuria, hypertension, oliguria, and proteinuria—were not significantly associated with persistent renal issues. However, acute kidney injury was significantly associated with poor outcome ($p = 0.00$), with 6 out of 16 AKI patients having persistent abnormalities. Treatment modality was also significant ($p = 0.034$), where children requiring dialysis or more intensive therapies had a higher chance of persistent renal impairment. (Table 4)

Table 4

Chi2/ Fischer Exact Test Associations of Clinical Features and Outcome at 3 Months

		Outcome at 3 Months Follow-up		Chi²/Fischer's Exact P-value
		Complete Recovery	Persistent Renal Issues	
Sore throat	Yes	75	5	0.252
	No	26	4	
Skin Infection	Yes	12	7	0.889
	No	59	32	
Edema	Yes	84	8	1.00
	No	17	1	
Hematuria	Gross	62	7	0.178
	Microscopic	27	0	
	Absent	12	2	
Hypertension	Yes	58	4	0.50
	No	43	5	
Oliguria	Yes	31	4	0.462
	No	70	5	
Acute Kidney Injury	Yes	10	6	0.00
	No	91	3	
Proteinuria	Present	63	7	0.483
	Absent	38	2	
Treatment given	Supportive only	34	2	0.034
	Diuretics	26	2	
	Antihypertensives	37	2	
	Dialysis	4	3	

DISCUSSION

Our study found that acute post-streptococcal glomerulonephritis (APSGN) in hospitalized children under 12 years was more common in males (56.4%), which is consistent with previous literature reporting a male predominance ranging from 55–70%(11, 12). The majority of affected children belonged to low socioeconomic backgrounds (55.5%), comparable to an Indian study where 58% of cases were from lower socioeconomic groups(13), underscoring the role of social determinants in APSGN prevalence.

A preceding sore throat was identified in 72.7% of our cohort, higher than the 60% reported in a Brazilian series(14) and 65% in a Nepalese cohort(15). Conversely, skin infection was less common in our study (17.3%), similar to findings from Saudi Arabia (18%)(16), but lower than the 30–40% reported in tropical regions(14, 15).

Edema (83.6%) and hematuria (87.2%) were the most frequent manifestations, aligning with studies from Nepal (edema 85%, hematuria 90%)(15) and Saudi Arabia (edema 80%, hematuria 92%)(16). Gross hematuria (62.7%) was more frequent in our patients compared to 55% reported in a North Indian study(17). Hypertension was observed in 56.4% of cases, which falls within the global range of 40–60%(18). Oliguria was present in 31.8% of our cohort, slightly higher than the 25% reported in Nepal(15). AKI occurred in 14.5% of patients, similar to the 12–18% range documented in multicenter studies(18, 19).

Proteinuria was observed in 63.6% of patients, a finding comparable to 65% in an Indian study(13) and 68% in a Pakistani series(12). Most children in our study were treated with supportive care, diuretics, or antihypertensives, with only 6.4% requiring dialysis. This dialysis rate is slightly lower than 8–10% reported in earlier series(18, 20), reflecting the generally self-limiting nature of APSGN.

Outcomes were favorable, with 64.5% fully recovered at discharge and 91.8% at 3 months. Similar recovery rates have been reported in Nepal (90% recovery at 3 months)(15) and India (92% recovery at 6 months)(17). Importantly, AKI was significantly associated with persistent renal abnormalities in our cohort, corroborating findings from Hogg et al., who noted that children with APSGN complicated by AKI had a 3-fold higher risk of long-term renal morbidity(21). Our data also showed that children requiring dialysis had worse outcomes, consistent with reports from Rodriguez-Iturbe(20), highlighting this subgroup as high-risk.

CONCLUSION

This study demonstrates that acute post-streptococcal glomerulonephritis in hospitalized children under 12 years is more common in males and those from low socioeconomic backgrounds, often following a sore throat. The predominant clinical features were edema, hematuria, and hypertension, while acute kidney injury occurred in a smaller subset. Most children recovered fully by three months, but acute kidney injury and the need for dialysis were strongly associated with persistent renal abnormalities. These findings emphasize the generally favorable prognosis of APSGN, while underscoring the importance of close monitoring and timely intervention in children presenting with severe disease.

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