

## Original Research Article

# CLINICAL SPECTRUM AND SEVERITY OF COVID-19 IN CHILDREN WITH KIDNEY DISEASES

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## ABSTRACT

**Background:** The severity of COVID-19 has varied among various demographic groups. Children often display milder kinds of comorbidities, such as chronic kidney disease (CKD), but adults are more susceptible to serious sickness. However, there is still a lack of information on children with glomerular disorders and chronic kidney disease who get COVID-19. **Objectives:** To study the clinical presentation, severity, and outcomes of COVID-19 in children with underlying kidney diseases.

**Material and Methods:** A retrospective descriptive study was conducted on 39 children aged 2 months to 18 years with CKD or glomerular diseases who were admitted with RT-PCR confirmed COVID-19 between March 2020 and February 2022. Data on demographics, kidney disease profile, immunosuppressive therapy, COVID-19 severity, inflammatory markers, treatment, and outcomes were analyzed.

**Results:** 53.8% of the 39 children were male. Idiopathic nephrotic syndrome was the most prevalent glomerular disease, accounting for 48.7% of cases and CKD for 51.3% of cases. 43.6% of cases were under immunosuppressive treatment. The most frequent presentations were respiratory symptoms (43.6%) and fever (61.5%). In 12.8% of cases, severe COVID 19 (SpO<sub>2</sub> < 90%) was noted. Five patients needed to be admitted to the intensive care unit, and one child died. Individuals with severe COVID 19 had higher levels of inflammatory markers, including ferritin, D-dimer, and CRP.

**Conclusion:** Even among children using immunosuppressants, the majority of children with renal disease and COVID-19 had mild to moderate symptoms. However, the risk of developing severe illness is increased in children with multiple comorbidities or advanced CKD. Appropriate supportive care and close observation are crucial.

**Keywords:** COVID-19, Children, Chronic Kidney Disease, Nephrotic Syndrome, Immunosuppression.

## INTRODUCTION

The SARS-CoV-2-caused coronavirus illness 2019 (COVID-19) became a worldwide epidemic in early 2020. Children have often had lesser symptoms or remained asymptomatic, whereas adults have been the ones who have suffered the most from severe sickness.<sup>[1,2]</sup> Children on immunosuppressive medication or with chronic illnesses, however, present particular difficulties in terms of infection susceptibility and disease progression.

Growing older and concomitant conditions such as diabetes mellitus, obesity, and chronic kidney disease (CKD) have been identified as risk factors for severe COVID-19 in adult patients.<sup>[3]</sup> However, the impact of COVID-19 on immunocompromised paediatric populations, particularly those with renal illnesses, is an increasing worry, even if the majority of children show very moderate symptoms.

Children frequently suffer from chronic kidney disease (CKD) and glomerular diseases, such as lupus nephritis, post-streptococcal glomerulonephritis (PSGN), and idiopathic nephrotic syndrome (INS).

These youngsters are at risk during the pandemic because many of these diseases need immunosuppressive treatment. However, little is known about the prevalence, clinical signs, and consequences of COVID-19 in these groups.<sup>[4]</sup> According to new research, adolescents who are immunosuppressed—including those using steroids or other immunomodulators for an extended period of time—may not always have severe COVID-19. According to a research by Canpolat et al., the majority of paediatric COVID-19 dialysis and kidney transplant patients had minimal symptoms, and there was only one recorded death.<sup>[5]</sup> Similar to this, Morello et al. noted that children with INS had modest illness histories, despite a small number of relapses and new-onset cases.<sup>[6]</sup>

According to a retrospective research by Goichberg et al., more than one-third of children with glomerular disorders and chronic kidney disease (CKD) were asymptomatic, with an infection incidence of 20.8%. Anti-SARS-CoV-2 antibody levels were not linked to immunosuppressive state or the severity of the illness.<sup>[7]</sup> The host-virus interaction in youngsters with compromised immune systems is intriguingly called into question by these findings. Immunosuppression may alter the immune response in a way that lessens the severity of COVID-19, despite initial concerns. Immunosuppressed paediatric liver transplant recipients did not have poorer outcomes, according to D'Antiga et al.<sup>[8]</sup> This might be because to a decreased cytokine response. It is unknown if comparable processes function in kids with renal disorders. Few studies have examined the effects of COVID-19 on paediatric nephrology patients in India. Since there are many kids with CKD and nephrotic syndrome, information from this group is essential for directing therapeutic management. This study aims to evaluate the intensity and clinical range of COVID-19 in children with renal disorders who were hospitalised to a tertiary paediatric nephrology centre during the pandemic's peak.

## **MATERIALS AND METHODS**

### **Source of Data**

The study utilized clinical records of all pediatric patients aged 2 months to 18 years who were admitted to Indira Gandhi Institute of Child Health, Bengaluru, between March 2020 and February 2022, and tested positive for COVID-19 by RT-PCR.

### **Study Design**

This was a descriptive, retrospective observational study.

### **Study Location**

The study was conducted at the Indira Gandhi Institute of Child Health, a tertiary care pediatric referral centre.

### **Study Duration**

The study spanned a period of 24 months, from March 2020 to February 2022.

### **Sample Size**

Based on a previously reported prevalence of 9.3% for COVID-19 in children with kidney diseases, with a precision of 10% and accounting for 10% attrition, the calculated sample size was 37. All consecutive eligible admissions were included, resulting in a final sample size of 39.

### **Inclusion Criteria**

Children aged 2 months to 18 years with RT-PCR confirmed COVID-19 and a diagnosis of chronic kidney disease (CKD Stage I–V) or glomerular diseases (e.g., idiopathic nephrotic syndrome, PSGN, IRGN, lupus nephritis, HUS, IgA vasculitis) were included.

### **Exclusion Criteria**

Patients with suspected but RT-PCR negative COVID-19, and those who left against medical advice (LAMA), were excluded.

### **Procedure and Methodology**

Clinical details including demographics, COVID-19 exposure, symptomatology, diagnosis of renal disease (based on clinical, laboratory, and histopathology where available), treatment history including immunosuppressants, and severity of COVID-19 (as per WHO pediatric guidelines) were collected. Data were recorded using a standardized proforma.

### **Immunosuppression Definition**

Children were considered immunocompromised if they were on steroids  $\geq 2$  mg/kg/day for  $\geq 2$  weeks or had CKD stage III or higher.

### **Statistical Methods**

Data were entered and analyzed using SPSS version 22. Descriptive statistics were used to summarize the data. Continuous variables were expressed as mean  $\pm$  SD or median with interquartile ranges. Categorical variables were expressed as percentages. Chi-square test or Fisher's exact test was used to assess associations between variables. A p-value  $< 0.05$  was considered statistically significant.

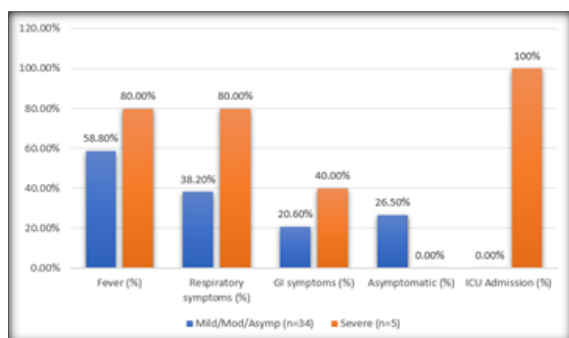
### **Data Collection**

Data were abstracted from case records and laboratory databases. Details of renal function, nephrotic parameters, inflammatory markers (CRP, IL-6, D-dimer, ferritin), and outcomes were systematically reviewed.

## **RESULTS**

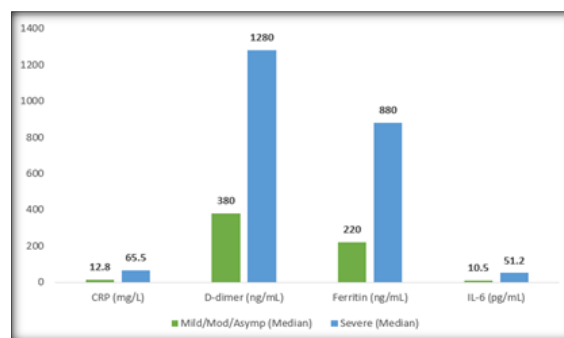
There were no discernible differences between children with severe COVID-19 and those with mild or moderate illness in terms of age, sex, the presence of CKD, or the use of immunosuppressants. Nonetheless, a greater percentage of CKD patients were seen in the severe group, indicating a potential trend. [Table 1]

ICU admission was statistically significant ( $p < 0.001$ ), and respiratory symptoms and ICU admission were more common in the severe group. The significance of respiratory distress as a severity predictor is shown by these findings. [Table 2]



**Figure 1**

Elevated levels of CRP, D-dimer, ferritin, and IL-6 were significantly associated with severe disease ( $p < 0.05$ ), indicating that hyperinflammatory response plays a central role in disease progression among children with kidney disease. [Table 4]



**Figure 2**

Severe disease-affected children had longer hospital stays ( $p = 0.01$ ) and needed far more intense treatments, such as oxygen and corticosteroids ( $p < 0.001$ ). Only the severe group had fatality, however it was not statistically significant. [Table 5]

**Table 1: Demographic and Disease Characteristics by COVID-19 Severity**

Characteristic	Mild/Mod/Asymp (n=34)	Severe (n=5)	p-value
Mean Age (years)	8.9 ± 4.7	10.1 ± 3.8	0.47
Male Gender (%)	52.9%	60.0%	0.76
CKD Present (%)	47.0%	80.0%	0.13
On Immunosuppressants (%)	44.1%	40.0%	0.87

**Table 2: COVID-19 Symptoms and Clinical Severity**

Clinical Feature	Mild/Mod/Asymp (n=34)	Severe (n=5)	p-value
Fever (%)	58.8%	80.0%	0.37
Respiratory symptoms (%)	38.2%	80.0%	0.07
GI symptoms (%)	20.6%	40.0%	0.31
Asymptomatic (%)	26.5%	0.0%	0.23
ICU Admission (%)	0.0%	100%	<0.001**

**Table 3**

Reason for Immunosuppression	13 Nephrotic syndrome 2 SLE 1 C1q Nephropathy 1 C3GN
Children on dialysis	3- Chronic peritoneal Dialysis
No of children on type of Immunosuppression	17 Glucocorticoids 1 Levamisole 2 Cyclophosphamide 2 MMF 1 Tacrolimus
Co- morbidities	2 seizure disorder 2 solitary kidney 1 Trichodystrophy 2 Hypothyroidism 1 Autoimmune Hemolytic Anemia

**Table 4: Inflammatory Marker Profile by Severity**

Marker	Mild/Mod/Asymp (Median)	Severe (Median)	p-value
CRP (mg/L)	12.8	65.5	0.01*
D-dimer (ng/mL)	380	1280	0.02*
Ferritin (ng/mL)	220	880	0.03*
IL-6 (pg/mL)	10.5	51.2	0.04*

**Table 5: Treatment Received and Outcome**

Parameter	Mild/Mod/Asymp (n=34)	Severe (n=5)	p-value
Oxygen Therapy (%)	2.9%	100%	<0.001**
Steroids for COVID-19 (%)	5.8%	80.0%	<0.001**
Mean Hospital Stay (days)	6.5 ± 2.9	11.2 ± 3.8	0.01*
Mortality (%)	0.0%	20.0%	0.08

## DISCUSSION

The majority of children with underlying kidney diseases who contracted COVID-19 had mild to moderate disease, according to our study. This confirms results from earlier research that even paediatric age groups with immunocompromised state are not always vulnerable to serious consequences.<sup>[6,7]</sup> There was no significant association between the number of Immunosuppression agents and the severity of COVID – 19 infection. Immunosuppressive treatment may reduce the hyperinflammatory response that causes severe COVID-19 symptoms, despite the fact that it has historically been linked to an increased risk of infection.<sup>[8,9]</sup> Even though 43.6% of the children in our research were using immunosuppressants, only five of them experienced severe COVID 19 infection, and the only one child who died had advanced chronic kidney disease along with other comorbidities.

In line with earlier paediatric research, there was a correlation between severity of COVID 19 and the need for intensive care treatment and an increase in inflammatory markers such CRP, ferritin, and IL-6.<sup>[10,11]</sup> These markers may be used as early predictors of the course of the illness. The majority of children needed supportive treatment, while the clinical presentation varied from mild to severe.<sup>[13]</sup> The results imply that children with underlying renal disorders with or without immunosuppression infected with COVID-19 can be effectively managed with close observation and prompt action when needed.<sup>[14]</sup>

## CONCLUSION

In children with glomerular disease and chronic kidney disease (CKD), COVID-19 often has a mild to moderate course. Severe outcomes were rare, even among children who received immunosuppressive agents. However, children with underlying comorbidities or severe chronic kidney disease should be closely monitored.

The study highlights the importance of providing tailored therapy and monitoring of inflammatory indicators in order to predict the course of the illness. Effective management of such cases may benefit from supportive care that avoids the needless stopping of immunosuppressants.

### Limitations of the Study

It is important to recognise the limitations of this study when evaluating the results. First, our capacity to infer causality is limited by the retrospective design. We depended on the completeness and correctness of documentation because the data was gathered from pre-existing medical records. Information bias may have been created like

reporting and documentation of the severity of symptoms.

Second, just one tertiary care facility was used for the study, which would have limited how broadly the findings can be applied. This institution may differ from other centres, especially those in rural or low-resource regions, in terms of therapeutic procedures, patient demographics, and resource availability. The statistical ability to identify meaningful correlations between clinical or laboratory markers and disease outcomes was further limited by the small sample size (n = 39) and the fact that only five patients experienced severe illness.

Third, there was no long-term follow-up to evaluate outcomes including recovery of renal function, glomerular disease relapses, or post-COVID-19 sequelae such multisystem inflammatory syndrome in children (MIS-C). Understanding the entire range of the illness trajectory or the possible long-term effects of COVID-19 on children with underlying renal problems is difficult in the absence of longitudinal data. To more accurately describe risk factors, immunological responses, and outcomes in this susceptible group, future studies should include multicenter, prospective designs with bigger sample numbers and long-term follow-up.

## REFERENCES

1. Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatr.* 2020 Jun;109(6):1088–95.
2. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, et al. Epidemiology of COVID-19 Among Children in China. *Pediatrics.* 2020 Jun;145(6):e20200702.
3. Jordan RE, Adab P, Cheng KK. Covid-19: risk factors for severe disease and death. *BMJ.* 2020 Mar 26;368:m1198.
4. Bhimma R, Adhikari M, Coovadia HM. Nephrotic syndrome in South African children: changing perspectives over 20 years. *Pediatr Nephrol.* 1997 Nov;11(5):429–34.
5. Canpolat N, Özen S, Gülhan B, et al. COVID-19 in children with chronic kidney disease. *Pediatr Nephrol.* 2021;36(5):1291–1299.
6. Morello W, Vianello FA, Proverbio E, et al. COVID-19 and idiopathic nephrotic syndrome in children: systematic review of literature and recommendations. *J Nephrol.* 2021;34(2):301–306.
7. Goichberg JWB, Magen D, Tenenbaum T, et al. COVID-19 infection in children and young adults with glomerular disease: a retrospective cohort study. *Pediatr Nephrol.* 2022;37(5):1081–1089.
8. D'Antiga L. Coronaviruses and immunosuppressed patients: The facts during the third epidemic. *Liver Transpl.* 2020 Jun;26(6):832–834.
9. Shekerdeman LS, Mahmood NR, Wolfe KK, et al. Characteristics and Outcomes of Children With Coronavirus Disease 2019 (COVID-19) Infection Admitted to US and Canadian Pediatric Intensive Care Units. *JAMA Pediatr.* 2020 Sep 1;174(9):868–873.
10. Harambat J, van Stralen KJ, Kim JJ, et al. Epidemiology of chronic kidney disease in children. *Pediatr Nephrol.* 2012 Mar;27(3):363–73.
11. Mantan M, Sethi GR, Dabas A. Management of nephrotic syndrome in children: A practical approach. *Indian J Pediatr.* 2020 Oct;87(10):803–812.
12. Marlais M, Wlodkowski T, Vivarelli M, et al. The severity of COVID-19 in children on immunosuppressive therapy. *Lancet Child Adolesc Health.* 2020 Jul;4(7):e17–e18.
13. Bhayana S, Gulati A. COVID-19 pandemic and its impact on pediatric nephrology patients. *Indian Pediatr.* 2020 Sep 15;57(9):849–850.