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C-reactive protein levels in febrile patients admitted to a tertiary care teaching hospital

Mukunda Timilsina[1], Eva Gauchan[2]

[1]Assitant Professor, [2]Professor, Department of Paediatrics, Manipal College of Medical Sciences, Pokhara, Nepal

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Abstract

Introduction: C-reactive protein (CRP) is an acute-phase reactant used as a diagnostic and prognostic marker in infectious and inflammatory conditions. This study evaluated the utility of CRP with symptom severity and hospital stay in febrile patients aged 6-60 months admitted to Manipal Teaching Hospital, Nepal.

Method: A cross-sectional study was conducted from 01 Nov 2024 to 30 Apr 2025, involving 194 febrile children admitted to the paediatric department after ethical approval from institutional review committee. Sample size was calculated using correlation coefficient estimation. Inclusion criteria were complete medical records and available CRP data; exclusions were parents who declined consent for their children. The association between CRP levels, symptom severity, and the length of hospital stay. The IBM SPSS was used to analyse data. A $p \leq 0.05$ was considered significant.

Result: In 194 febrile paediatric patients, the mean age was 30.98 months. Common symptoms were cough 90(46.4%), vomiting 55(28.4%), and seizures 41(21.2%). The CRP levels varied, with higher levels associated with higher grades of fever ($p=0.005$) and longer hospital stays ($r=0.45$, $p<0.001$). Children with CRP levels >48 mg/l had an average hospital stay of 7.8 days, compared to 4.5 days for those with lower CRP levels.

Conclusion: Elevated CRP levels may be associated with increased severity and longer hospitalisation. Further research is needed to standardise and use age CRP levels in management of febrile paediatric patients in resource-limited settings like Nepal.

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Correspondence

Dr. Mukunda Timilsina, Department of Paediatrics, Manipal College of Medical Sciences, Pokhara, Nepal. Email: callmukunda@gmail.com, Telephone: +977 9856036389

Introduction

First described by Tillet and Francis in 1930, the C-reactive protein (CRP) is now widely used in diagnosing and monitoring inflammatory and infectious diseases.[1] It is an acute-phase reactant synthesised by the liver in response to systemic inflammation through interleukin-6 (IL-6) stimulation.[1] Its clinical utility spans bacterial infections, autoimmune disorders, and certain malignancies.[2] In children aged 6 to 60 months, fever is a leading cause of hospitalisation due to infection.[3] The CRP has been shown to assist in distinguishing bacterial from viral infections, as elevated levels are more suggestive of bacterial aetiology.[4]

Although CRP is a valuable diagnostic tool, its interpretation can be influenced by patient age, comorbidities, and non-infectious inflammatory conditions.[5] Studies have highlighted its role not only in diagnosis but also in monitoring treatment response and predicting disease severity and outcomes.[6,7] However, variations in CRP thresholds and inconsistent findings across populations suggest a need for contextual validation.[5] Over-reliance on empirical treatment in resource-limited settings may contribute to antimicrobial resistance, underlining the importance of accurate, accessible diagnostic tools.

Nepal experiences a high burden of paediatric infectious diseases compounded by malnutrition, healthcare inaccessibility, and delayed diagnosis.[8,9] Manipal Teaching Hospital, Nepal, a major referral centre, febrile illnesses account for a significant proportion of paediatric admissions. There is a need to evaluate baseline CRP levels in febrile paediatric patients, assess its diagnostic utility in identifying underlying conditions, and examine its correlation with hospital stay duration.[10-12] This study aims to bridge this gap.

Method

This study employed a quantitative, observational design to investigate the role of CRP in febrile paediatric patients. The research was conducted at Manipal Teaching Hospital (MTH), Nepal, from 01 Nov 2024 to 30 April 2025, spanning six months following ethical approval from the Institutional Review Committee (IRC) (Reference ID number 591). Written informed consent was obtained from the parents or legal guardians of children.

The study focused on febrile children aged 6 to 60 months admitted to MTH during the study period. Febrile children were defined as those presenting with an axillary temperature ≥38°C or a history of fever lasting 48 hours or more before admission. Patients were enrolled using a consecutive sampling method, including all eligible children who met the criteria during the study period.

Inclusion criteria were children aged 6–60 months presenting with fever, complete medical records including CRP levels, and documented parental consent.

Sample size was calculated to estimate a correlation between CRP levels and clinical outcomes. The calculation assumed a moderate correlation coefficient (r=0.3), a 95% confidence level (Z=1.96), a margin of error (E=0.1), and a power of 80%. The formula used was: $n=(Z^2*(1-r^2))/(E^2*r^2)=(1.96^2*(1-0.3^2))/0.1^2\approx172$.

Serum CRP levels were measured in the central clinical laboratory of MTH using a Fluorescence Immunoassay technique. The assay was performed by latex agglutination method with a proper titre; CRP levels were categorised into six ordinal groups: negative (<6 mg/L), 6 mg/L, 12 mg/L, 24 mg/L, 48 mg/L, and 96 mg/L as reported by our laboratory.

Data were collected by the researchers using structured forms, and all analyses were performed using IBM SPSS Statistics Version 26. Descriptive statistics were computed for all variables. Associations and correlations were evaluated using appropriate tests (ANOVA test and correlation), and a $p\leq0.05$ was considered statistically significant.

Result

A total of 194 febrile paediatric patients aged 6 months to 60 months were enrolled in the study. The mean age of the participants was

30.98±19.32 months, with 110(56.7%) males. At presentation, the mean temperature was 101.07±1.39 F and duration of fever was 4.34±7.02 days. Those with higher CRP values presented with a higher grade of fever (p=0.005), as determined by one way ANOVA test. Apart from fever, cough 90(46.4%), vomiting 55(28.4%), seizures 41(21.2%), loose stool 31(16%) and fast breathing 26(13.4%) were the common presenting symptoms, Table 1. Less common symptoms included a runny nose, abdominal pain, noisy breathing, poor feeding, and sore throat. Of the total patients, 56(28.9%) had CRP value 0, twenty (10.3%) had 6, forty-six (23.7%) had 12, Table 2.

Upper respiratory tract infections 40(20.62%), pneumonia 38(19.59%), febrile seizures 34(17.53%), diarrhoea 30(15.46%) and urinary tract infections 8(4.12%) were common causes of febrile illness, Figure 1.

A positive correlation was observed between elevated CRP levels and hospital stay, Pearson Correlation Coefficient (r=0.45, p<0.001). Patients with CRP levels exceeding 48 mg/L had an average hospital stay of 7.8±2.3 days compared to 4.5±1.5 days in those with CRP levels <24 mg/L.

Table 1. Common presenting symptoms of febrile paediatric patients, n=194

Symptoms	n	%
Cough	90	46.4
Vomiting	55	28.4
Seizures	41	21.2
Loose stool	31	16
Fast breathing	26	13.4
Running nose	24	12.4
Abdominal pain	18	9.3
Noisy breathing	17	8.8
Poor feeding	16	8.2
Sore throat	9	4.6
Rashes	8	4.1
Difficulty breathing	6	3.1

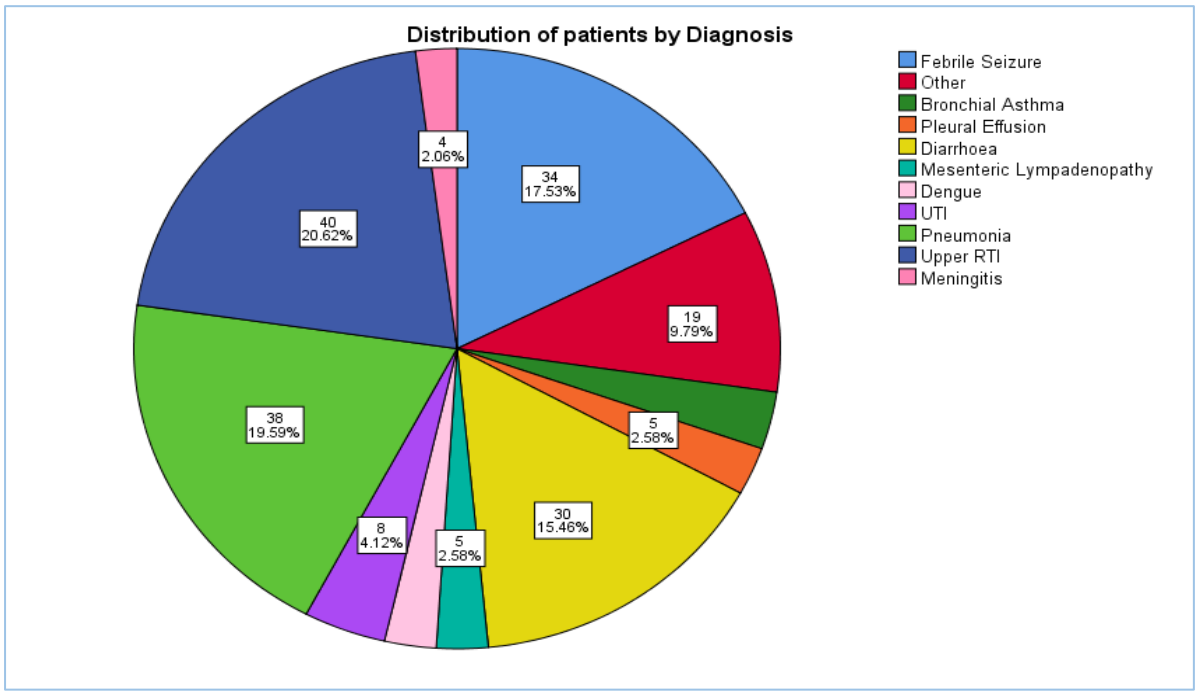

Figure 1. Distribution of febrile paediatric patients by diagnosis, n=194

Table 2. Distribution of febrile paediatric patients by CRP value, n=194

CRP Value	n	%
Negative	56	28.9
6	20	10.3
12	46	23.7
24	31	16
48	35	18
96	6	3.1

Discussion

This study provides a comprehensive analysis of febrile illnesses among paediatric patients aged 6 to 60 months, highlighting significant trends in demographics, symptomatology, clinical outcomes and role of C-reactive protein (CRP) as a diagnostic and prognostic marker. We found a statistically significant positive correlation between elevated CRP levels and length of hospital stay (Pearson's r=0.45, p<0.001). Additionally, children with CRP levels >48mg/l had longer hospital stays (mean 7.8 days) compared to those with CRP <24 mg/l (mean 4.5 days).

We observed a higher prevalence of febrile illness among males (56.7%), which aligns with existing literature suggesting that male children may be more susceptible to infections during early childhood, potentially due to differences in immune system development and hormonal influences.[13] Females are known to mount stronger innate and adaptive immune responses, which may offer greater protection during early life.[14] However, some studies report no significant sex-based differences in disease severity, suggesting that the clinical impact of these biological differences may vary depending on the population and setting studied.[15]

The most common symptoms observed in our cohort were cough (46.4%), vomiting (28.4%), seizures (21.2%), and loose stools (16%), reflecting the typical spectrum of febrile illnesses in young children. Respiratory and gastrointestinal infections were predominant, consistent with findings from other paediatric populations.[16] The relatively high incidence of seizures emphasises the need to consider febrile seizures in the differential diagnosis of febrile children, particularly in the absence of other focal signs. The leading causes of fever in this study were upper respiratory tract infections (20.6%), pneumonia (19.1%), febrile seizures (17.5%), diarrhoea (15.5%), and urinary tract infections (4.1%). These results are consistent with findings from similar studies in paediatric populations, where respiratory and gastrointestinal illnesses are the most common aetiologies.

The CRP levels varied among participants, with a significant proportion exhibiting elevated values. Higher CRP levels were associated with more severe fever and longer hospital stays. Specifically, patients with CRP levels exceeding 48 mg/L had an average hospital stay of 7.8 days, compared to 4.5 days in those with CRP levels below 24 mg/L. This positive correlation supports CRP's role as a prognostic marker in paediatric febrile illnesses, and similar observations have been noticed in other studies as well.[17]

Stratified analysis revealed that younger children (6–12 months) with elevated CRP levels experienced longer hospitalisations compared to older children, possibly due to their underdeveloped immune systems and higher vulnerability to severe infections.[18] Delayed presentation and diagnosis, common in resource-limited settings, may also contribute to prolonged hospital stays in this population.

These findings have important implications for clinical practice in settings like Nepal. The CRP testing could serve as a cost-effective tool for triaging febrile patients. Elevated CRP levels may prompt early empirical antibiotic therapy and further diagnostic investigations, while low CRP levels could guide more conservative management, helping to reduce unnecessary

antibiotic use and combat antimicrobial resistance.[19]

Furthermore, CRP cannot reliably distinguish between bacterial and certain viral infections (e.g., dengue, influenza), highlighting the need to combine CRP with clinical evaluation and other laboratory tests for accurate diagnosis.[20] However, the study also highlights the need for region-specific research to account for local disease epidemiology and healthcare infrastructure. For example, the high prevalence of malnutrition and co-infections in Nepal may influence CRP levels and their interpretation, necessitating further investigation.[21]

Some of the limitations of present study for generalizability may be that it was a single tertiary care centre, a cross-sectional design limiting the ability to assess changes in CRP levels over time or evaluate treatment response. The lack of consistent microbiological testing prevented differentiation between bacterial and viral infections, affecting the interpretation of CRP values. Other confounding factors, such as nutritional status, prior medication use, and comorbidities were not systematically recorded. The absence of age-specific CRP values and follow-up limited its prognostic significance and long-term outcomes.

Conclusion

This study demonstrated that elevated CRP levels correlated with more severe clinical presentations and longer hospital stays in febrile children. While CRP is a non-specific inflammatory marker, it may support early clinical decisions and counselling, especially in resource-limited settings. Multi-centre studies with larger cohorts and follow-up are essential to validate its predictive role and integration into standardised paediatric care protocols.

Author contribution

Concept and design: MT; Literature search: EG; Data collection: All; Data analysis: All; Draft manuscript: All; Final manuscript and accountability: All

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Supplementary material

The data and supplementary material that support the findings of this study are available from the corresponding author upon reasonable request.

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