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REVIEW ARTICLE

IMPACT OF POINT-OF-CARE TESTING ON CLINICAL OUTCOMES IN PEDIATRIC ACUTE ILLNESSES

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ABSTRACT: This review evaluates the utility of C-reactive protein (CRP) as an inflammatory biomarker in pediatric respiratory and bacterial infections, focusing on its application in primary and ambulatory care settings. Utilizing point-of-care (PoC) CRP testing, the research aims to enhance diagnostic accuracy and inform clinical decisions. Elevated CRP levels signify acute inflammation, common in diseases such as asthma and allergic rhinitis, where immune responses are complex. High-sensitivity CRP assays may help grade inflammation severity. The study, which employed the Affinion CRP test for rapid results, highlights CRP's role in identifying higher-risk cases but underscores its limitations in excluding severe infections without supplementary clinical data. Comparing CRP to procalcitonin revealed that the latter often provides superior sensitivity and specificity for detecting invasive bacterial infections. The findings advocate for incorporating CRP into structured diagnostic protocols, which could optimize pediatric care by reducing unnecessary antibiotic use. Standardized cutoff values and multimodal biomarker strategies are recommended for refining diagnostic approaches.

Keywords: C-reactive protein, allergic rhinitis, point -of-care.

INTRODUCTION:

An allergic reaction occurs when the immune system mounts an exaggerated response to an allergen, a substance that is typically harmless. However, C-reactive protein (CRP) plays a significant role in infection management and is a valuable biomarker in pediatric care. CRP, primarily synthesized in the liver through an IL-6-dependent mechanism, serves as a key mediator in the acute-phase response [1].

Recent research suggests that CRP actively contributes to disease pathogenesis and has a critical role in diagnosing and managing pediatric infections. The American Heart Association and the Centers for Disease Control and Prevention have classified CRP levels into three cardiovascular risk categories [2].

CRP is a well-established biomarker of inflammation and is frequently measured to evaluate systemic inflammatory conditions, such as pneumonia, rheumatic diseases, and intestinal disorders [3,4,5].

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In pediatric practice, CRP testing aids in differentiating bacterial from viral infections, thereby guiding appropriate treatment decisions. However, its effectiveness is enhanced when combined with other biomarkers such as procalcitonin (PCT) and white blood cell (WBC) counts to improve diagnostic accuracy in febrile children [6,7].

Clinical Impact of CRP Testing in Pediatric Care

CRP testing has demonstrated substantial benefits in improving clinical outcomes for pediatric patients. For example, a study involving febrile children found that integrating CRP measurements into diagnostic protocols led to a 20% reduction in unnecessary hospitalizations and antibiotic use [8,9]. Moreover, the ability to quickly assess CRP levels in emergency settings has facilitated faster and more accurate treatment decisions, contributing to better patient recovery rates [9].

PoC CRP Testing in Low-Resource Settings

Point-of-care (PoC) CRP testing, such as the Affinion CRP test, offers a significant advantage in low-resource or rural healthcare settings. The Affinion CRP test, conducted using the Affinion AS100 Analyzer (Alere, USA), provides rapid results within a range of 5 mg/L to 200 mg/L. Studies have shown that PoC CRP testing reduces unnecessary antibiotic prescriptions and hospital admissions, especially in settings with limited access to advanced laboratory facilities [10]. In rural healthcare environments, PoC CRP testing allows for timely intervention, reducing delays in treatment initiation. Pilot studies in low-resource areas have demonstrated that these tests enhance diagnostic accuracy and improve patient management, particularly for respiratory and febrile illnesses in children [10].

Patient-Centered Outcomes

Beyond its role in clinical decision-making, CRP testing significantly impacts patient and family outcomes. By distinguishing bacterial from viral infections more effectively, CRP testing helps reduce unnecessary visits to emergency rooms, lowering the burden on both families and healthcare facilities. Additionally, it improves communication between healthcare providers and parents, allowing for more informed discussions about treatment options. Parents are more likely to trust clinical recommendations when objective biomarker data supports medical decisions, thereby enhancing adherence to prescribed treatments [11].

Standardized CRP Cut-off Values and Challenges

Although CRP is widely used in clinical practice, standardized cut-off values for pediatric populations remain inconsistent. Different clinical settings may interpret CRP values differently due to variations in laboratory methods, patient demographics, and co-existing conditions. Some guidelines define low-risk CRP levels as <20 mg/L and high-risk as ≥20 mg/L, yet these thresholds do not universally apply to all pediatric populations [11,12]. Further research is required to establish reliable reference ranges and context-specific guidelines.

Emerging Molecular Diagnostics

Advancements in molecular diagnostics, such as next-generation sequencing (NGS) and polymerase chain reaction (PCR)-based technologies, offer promising alternatives for diagnosing pediatric infections. These tools enable rapid and precise pathogen identification, complementing CRP testing and reducing diagnostic uncertainty. Integrating CRP with molecular diagnostics could enhance the accuracy of infection differentiation, leading to improved clinical outcomes [13,14].

ERNIE2 Trial and Clinical Utility of CRP

The ERNIE2 trial is a cluster randomized controlled trial (RCT) involving children with acute infections who present at family practices (FPs). It follows well-

established Clinical Practice Guidelines (CPGs) for evaluating febrile infants, including the Step-by-Step model, the PECARN rule, and the American Academy of Pediatrics (AAP) guidelines. These guidelines use a stepwise risk stratification approach for infants younger than 90 days, incorporating factors such as age, clinical presentation, urinary tract infection (UTI) indicators, and biomarker thresholds [15,16,17]. The trial found that CRP, when used in conjunction with PCT and ANC, improved risk stratification for serious bacterial infections in febrile infants. However, CRP alone was insufficient for definitive diagnosis, emphasizing its role as an adjunctive biomarker rather than a standalone diagnostic tool [17].

Figures and Tables for Enhanced Understanding

To facilitate better interpretation of CRP testing, visual aids such as figures or tables summarizing key findings can improve accessibility [18-20]. For example, a comparison table illustrating CRP versus PCT performance in pediatric infections or a decision algorithm for interpreting CRP levels could enhance understanding and clinical applicability [21-29].

Parameter	C-Reactive Protein (CRP)	Procalcitonin (PCT)
Primary Use	Inflammation marker, non-specific for bacterial infections	More specific for bacterial infections
Sensitivity for Bacterial Infections	Moderate	High
Specificity for Bacterial Infections	Low to Moderate	High
Early Detection of Sepsis	Delayed response (rises in 6-12 hrs.)	Rapid response (rises within 2-4 hrs.)
Peak Levels	24-48 hours	6-24 hours
Half-life	19 hours	25-30 hours
Differentiation between Viral & Bacterial Infections	Limited utility	More reliable
Correlation with Disease Severity	Weak	Strong
Use in Antibiotic Stewardship	Less useful	More useful in guiding initiation/discontinuation
Cost	Lower	Higher

Conclusion

CRP remains a valuable adjunctive biomarker in pediatric infection management, particularly when combined with other clinical indicators such as PCT and WBC counts. The implementation of PoC CRP testing in low-resource settings holds promise for improving healthcare access and timely treatment decisions. Additionally, CRP testing enhances patient-centered outcomes by reducing unnecessary emergency visits and fostering better communication between healthcare providers and families. Future research should focus on refining biomarker thresholds and integrating CRP with next-generation diagnostic tools to further enhance pediatric care.

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