Original Article

Is C-reactive protein a valuable marker for severe bacterial infection?

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ABSTRACT

Objective

To assess the values of C-reactive protein (CRP) in predicting severe bacterial infection in febrile children admitted to Prince Ali Hospital.

Patients and Methods

A prospective study was conducted in 900 patients aged one month to six years who presented to the emergency department with fever of 38.5°C or more. Two hundred patients fulfilled the criteria of admission to the pediatrics department. CRP, complete blood count (CBC), chest x-ray, ESR, blood culture and urine culture were taken upon admission.

Results

During the study period from April 2011 to September 2011, 200 patients were admitted to the hospital with fever. Twenty five patients out of 200 (12.5%) were
diagnosed to have severe bacterial infection. All of these cases (100%) showed strongly positive CRP and 88% were less than one year of age. The rest of the patients (175 patients, 87.5%) had non-severe bacterial infection.

The most common diagnoses were pharyngiotonsilitis, otitis media and gastroenteritis. Among those with non-severe bacterial infection, only 48 (27%) patients had positive CRP. Other laboratory data like ESR and white blood cell (WBC) were not significant, as only 19 (9.5%) patients showed high ESR more than 15ml/hr, while only 26 (13%) showed elevated WBC more than 10,000/mm3 among all the patients in both groups.

Conclusion

CRP was a valuable marker in predicting severe bacterial infection in children below one year of age, and it performed better than WBC and ESR. (Rawal Med J 2012;37:152-154).

Keywords

CRP, c-reactive protein, fever.

INTRODUCTION

Fever is one of the most common reason for visits to the emergency department by children younger than six years of age, accounting for approximately 10-35% of admissions.\textsuperscript{1,2} The majority of these patients will have a benign cause for their fever, but what matters are those who have severe bacterial infection (SBI). Distinguishing the child with SBI that include sepsis, bacteremia, urinary tract infection (UTI), meningitis, osteomyelitis and pneumonia, is important and but can be difficult.\textsuperscript{3,4} This
is particularly true in infants and young children where SBI represent 10-25% of febrile illnesses.\textsuperscript{3-5}

Several guidelines exist to aid in the evaluation and work-up of these children, but they are all controversial. Thus, there is a need for a specific and sensitive marker of infection. CRP is an acute phase reactant synthesized by the liver in response to the elevated level of the cytokines.\textsuperscript{2} It is produced within 4-6 hours after onset of tissue injury or inflammation and doubled every 8h before peaking around 36-50 hrs. It has been long studied as a sensitive marker of bacterial infection.\textsuperscript{4,5} The aim of this study was to assess value of CRP in predicting SBI in febrile children admitted to our institution.

**PATIENTS AND METHODS**

This prospective study was conducted in Prince Ali Hospital from April 2010 to September 2011. It included children younger than 6 years of age who presented to the emergency department with axillary temperature of more than 38.5.\textsuperscript{C} All patients who met one or more of the following criteria were admitted: Infants below three months of age with fever more than 38.5, with or without focus, children with history of chronic pathology like cystic fibrosis with fever, Ill looking febrile children and children more than three months of age without focus.

Complete history, physical examination and investigations were done to all patients. CBC, blood culture, ESR and CRP level were taken. A urinalysis and urine culture was obtained by bladder catheterization in patients under 6 months of age and by urine bag in children more than 6 months of age. A chest X-ray was performed to all patients and lumbar puncture was performed when meningitis was suspected.
CRP analysis was done by using the human CRP latex test with the qualitative-semi quantitative method. Qualitative method was performed by using a mixture of one drop of the patient serum which was added to one drop of human CRP latex test. It was considered positive if the clotting level was 12mg/ml or more and it was negative if the level was less than 12mg/ml.

RESULTS

Two hundred patients met the inclusion criteria for admission, 40 (20%) patients were females and 160 (80%) were males. The median age was 24 months; 50 (25%) patients were infants younger than 3 months of age. One hundred (50%) presented with fever for less than 24h.

SBI was diagnosed in 25 (12.5%) children as follows: septicemia in 7 (3.5%) where the most common organism was staphylococcus aures, pyelonephritis in 7 (3.5%) where the most common organism was E coli, meningitis 5 (2.5%) and pneumonia in 6 (3%) patients (Table 1). All of them showed strongly positive CRP.

Table 1. Most common severe bacterial infections with raised CRP (n=25).

<table>
<thead>
<tr>
<th>Disease</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia</td>
<td>7</td>
<td>3.5%</td>
</tr>
<tr>
<td>Pylonephritis</td>
<td>7</td>
<td>3.5%</td>
</tr>
<tr>
<td>Meningitis</td>
<td>5</td>
<td>2.5%</td>
</tr>
<tr>
<td>pneumonia</td>
<td>6</td>
<td>3%</td>
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</tbody>
</table>

One hundred seventy five children had non severe bacterial infection; pharyngotonsilitis in 50 (25%), otitis media in 30 (15%), gastroenteritis in 30 (15%) and bronchiolitis in 30 (15%) patients. The last 35 patients were diagnosed as non-
specific viral infection. Only 48 (27%) of them showed positive CRP (27%).

Nineteen patients only (9.5%) showed high ESR more than 15ml/hr, while twenty six patients only (13%) showed elevated WBC more than 10,000/mm3 among all the patients in both groups.

**DISCUSSION**

The rate of synthesis of CRP increases within few hours following an initial insult with peak levels at 48 to 72 hours following the onset of inflammation. By excluding infections from the differential diagnosis, it is possible to avoid the use of potentially harmful antibiotics. A positive blood culture usually requires 24 hours or longer before results can be obtained. Physicians are, therefore, looking for a method that promises to be either sensitive or specific for the detection of infection; one that would be helpful to decide initiation of antibacterial therapy.

Our study showed that CRP helped to differentiate SBI from non-severe bacterial infection. Many other studies showed that CRP is a good indicator for SBI. A Meta-analysis of 1230 children with pneumonia showed that children with serum CRP exceeding 40-60mg/L was more likely to have severe bacterial pneumonia than children with lower serum concentration.

Kunze studied 171 patients between the age of one month-16 years, of which 106 were Adenovirus (ADV) positive, 32 were ADV negative and reported that those with ADV positive showed significantly elevated serum CRP. A systematic review of studies assessing the diagnostic accuracy of CRP in bacterial infection revealed that CRP was of a moderate value for ruling out serious bacterial infection, in contrast to our study where CRP was of high value.
A study showed that ESR and differential leukocyte count were two valuable tests in febrile UTI and may be useful for localization of UTI level, but the total leukocyte count and CRP level are not useful.\textsuperscript{15} However, our study and other studies\textsuperscript{16} showed that CRP level and ESR are of value in identifying those children with UTI who have marked host reactions and severe infection. Other studies were focusing on different markers of infection like platelets\textsuperscript{8} and procalcitonin (PCT).\textsuperscript{7,14} Both were valuable in distinguishing SBI and may be more useful if combined with CRP.

CONCLUSION

In conclusion, CRP was a valuable marker to determine severe bacterial infection in children, mainly those below one year of age.

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REFERENCES


