C-reactive protein and lipid abnormalities in children suffering from pneumonia

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ABSTRACT

The aim of the present study was to evaluate the changes in serum lipids, lipoproteins and C-reactive protein in children with pneumonia. 40 children suffering with pneumonia between age group 5-12 years, and 40 normal healthy controls matched in age were included in this study. On the day of admission analysis was done for serum total cholesterol, triglycerides, HDL and C-reactive protein, LDL cholesterol was calculated by Friedwald’s formula. The significant increase in the concentration of serum total cholesterol, triglycerides and LDL cholesterol was observed in pneumonic children than the controls. Significantly decreased concentration of HDL cholesterol was found in patient group than the control group. Also an increased concentration of C-reactive protein was observed in children with pneumonia as compared to controls.

Keyword: Pneumonia; C-reactive protein; Total Cholesterol; Triglycerides; HDL Cholesterol; LDL cholesterol

INTRODUCTION

Chlamydia pneumoniae infection has recently been associated with acute myocardial infarction and coronary heart disease [1]. However, the causal relationship between C. pneumoniae and atherosclerosis has remained unresolved. Acute microbial infections are known to affect the lipid metabolism in both experimental animals and humans [2]. Atypical bacteria such as Mycoplasma pneumoniae are being increasingly recognized as common pathogen in lower respiratory tract infections. These atypical pneumonias may become more
complicated if they are not treated with adequate antimicrobial agent [3].
Pneumonia elicits a powerful inflammatory response. The release of inflammatory mediators from activated mononuclear phagocyte cells contributes an important part of the host response to infection. Of these mediators, interleukin-6 is a major inducer of acute phase proteins including C-reactive protein (CRP) [4, 5]. The early determination of concentration of CRP within 24 to 48 hours in the serum is a well-established laboratory test for the diagnosis and monitoring of different acute inflammatory responses. [5] Inflammatory parameters and chronic & acute infectious diseases have been considered to modify stroke risk, independent of conventional risk factors. Atherosclerosis is today perceived as a chronic inflammatory vascular condition and infectious diseases are believed to contribute to its pathophysiology [6]. A prominent hypothesis is that the increased coronary artery disease risk in connection with a C. pneumoniae infection might be mediated by the induction of a pro-atherogenic lipoprotein profile as the acute phase response to an infection targeted primarily to protect the host from further injury, is accompanied by changes in the lipid metabolism similar to those proposed to promote atherogenesis. These changes comprise, in particular, raised concentration of triglycerides and decreased concentration of high density lipoprotein (HDL) cholesterol [7].
The present study was carried out with the aim to evaluate the changes in the lipid parameters as a risk factors for the coronary artery diseases and to observe the presence of CRP in serum of patients with pneumonia and was compared with the healthy controls.

MATERIAL AND METHODS
The present study was carried out in the Department of Biochemistry, Government Medical College, Miraj. The study was approved by institutional ethical committee. Study group consisted of 40 children with pneumonia aged between 5 to 12 years with a clinical and radiological diagnosis of pneumonia in the form of new infiltrates on chest X-ray, and 40 healthy children as controls. The written consent form was taken from the parents of the patients and controls. The patients with pneumonia who had human immunodeficiency virus (HIV) infection, tuberculosis and fungal infection were excluded from the study.

Blood samples were drawn by venipuncture and collected in vacuum tubes and left to clot at room temperature, then centrifuged and the serum fraction was separated and analyzed for total cholesterol, HDL cholesterol, triglycerides and C-reactive protein.

The C-reactive protein was determined by Latex slide test [8] method. In this, rapid CRP contains polystyrene latex particles coated with anti-CRP monoclonal antibody. When serum containing CRP levels ≥0.6 mg/dL, reacts with the latex reagent, a clearly visible agglutination was observed macroscopically within 2 minutes. Serum total cholesterol was estimated by Cholesterol Oxidase-Peroxidase [9] method and HDL cholesterol was measured after precipitation of non-HDL Cholesterol fractions with phosphotungstic acid and estimated using Cholesterol Oxidase-Peroxidase [10] method and serum triglyceride by enzymatic [11] method. The concentration of LDL cholesterol was calculated by using Friedwald’s [12] formula.

RESULTS
The present study was aimed to determine an acute phase C-reactive protein and to estimate total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol levels in children with pneumonia. The results of the continuous variables were mentioned as mean ± SD. The results were compared between patients and controls for continuous variables with
independent ‘t’ test, and the change in CRP was assessed by chi square test, p values of <0.05 were considered significant. There was no significant (p>0.05) difference found in the age of patient group when compared to controls. The cholesterol level was significantly higher with 95% confidence interval of 4.58 to 25.44 mg/dL and t value of 2.86 with associated p value p=0.0054 when compared with the healthy controls. Triglyceride and LDL Cholesterol levels were also significantly higher as compared to healthy controls with 95% confidence interval of 21.54 to 54.84 mg/dL & 8.32 to 31.40 mg/dL and t value of 4.57 & 3.43 and associated p values p<0.0001 & p<0.0001 respectively. While HDL Cholesterol was significantly lower with p value of p<0.0001 among pneumonic children compared with that of the healthy controls with 95% confidence interval of 10.27 to 14.71 mg/dL and t value of 11.1. Also the atherogenic ratio of total cholesterol to HDL cholesterol was calculated, it differ significantly among the children with pneumonia to that of healthy controls. The 95% confidence interval for total cholesterol/HDL cholesterol ratio was 1.80 to 2.94 and t value of 8.30 and associated p value of p<0.0001. The qualitative test for CRP was negative for all healthy controls, where as it was positive in 38 pneumonic children and negative in 02 children with pneumonia. The results are depicted in table no. 1 and figure 1 shows the graphical presentation of the results.

Table 1: Age, gender, and biochemical parameters in children suffering from pneumonia and healthy controls

<table>
<thead>
<tr>
<th></th>
<th>Healthy subjects</th>
<th>Pneumonia patients</th>
<th>‘p’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>11.26 ± 3.2</td>
<td>10.18 ± 2.71</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Total cholesterol (mg/dL)</strong></td>
<td>183.11 ± 16.90</td>
<td>198.12 ± 28.52</td>
<td>0.0054</td>
</tr>
<tr>
<td><strong>Triglycerides (mg/dL)</strong></td>
<td>132.88 ± 36.77</td>
<td>171.08 ± 38.03</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td><strong>HDL cholesterol (mg/dL)</strong></td>
<td>43.20 ± 4.88</td>
<td>30.71 ± 5.10</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td><strong>LDL cholesterol (mg/dL)</strong></td>
<td>113.3 ± 17.43</td>
<td>133.2 ± 32.23</td>
<td>0.0010</td>
</tr>
<tr>
<td><strong>Total cholesterol/HDL Cholesterol</strong></td>
<td>4.29 ± 0.63</td>
<td>6.67 ± 1.69</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td><strong>C-reactive protein</strong></td>
<td>Positive 00 (0%)</td>
<td>Positive 38 (95%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>Negative 40 (100%)</td>
<td>Negative 02 (05%)</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

Pneumonia is currently the sixth leading cause of death in United States and number one cause of mortality from infectious diseases. Certain populations have a high risk of pneumonia. In developing countries the incidence of lower respiratory tract infection in children has at the upper extreme been over 1000 cases per 1000 person-years [13]. In pneumonia the close proximity of infection and tissue damage in the parenchyma to the pulmonary circulation produces an immunologic stimulus to systemic CRP synthesis. In this respect, the CRP response that is mediated by cytokines would be expected to be greater in pneumonia where there is more tissue damage [4, 5].

Paul L McCarthy et al showed C-reactive protein is a specific and sensitive indicator of bacterial infection. CRP positive is more definitive than high WBC or ESR or temperature in identifying bacterial pneumonia. The CRP test should be used in conjunction with clinical assessment and radiological data in decisions regarding therapy for childhood pneumonia [14].

A prospective study found an independent association between C. pneumoniae seropositivity and progression of the intima-media thickness and ischemic events, effects that were particularly expressed in patients with increased CRP [15].

In our study we observed an increase in CRP level in children with pneumonia than in controls, as the latex test for CRP was positive in 38 pneumonic children out of 40 and it was negative in all control samples, the positive samples were indicative of the CRP level ≥0.6 mg/dL. We also investigated serum lipid profile in patients with pneumonia patients and compared with the healthy age matched controls. Serum total cholesterol level was significantly increased in patients than in controls, while, the rise in the serum triglycerides, and LDL cholesterol levels was also highly significant. There was inverse association found between the HDL cholesterol and pneumonia which was statistically significant.

Chronic infections are caused by the ability of several microorganisms like Helicobacter pylori, Chlamydia pneumoniae and the agents of dental infections are to be related to both CAD and cardiovascular risk factors has been
recently proved [1, 16]. D. R. Kang et al found Serum levels of total cholesterol; albumin, total protein and body mass index (BMI) were lower in community acquired pneumonia cases in soldiers than in controls [17]. The study conducted by Iina Volanen, in apparently healthy children, showed that *C. pneumoniae, H. pylori* seropositivity in childhood is not associated with pro-atherogenic alterations in serum lipid, lipoprotein, or apolipoprotein values [7]. Our findings are similar to Iscan A. et al who observed, during the acute stage of infections, serum triglyceride concentration clearly increases, whereas HDL cholesterol concentration decreases [18]. Therefore our findings suggest that pneumonia do increase cardiovascular disease risk by altering the lipid metabolism in early age which are the independent risk factors for cardiovascular diseases. Various mechanisms have been suggested whereby infection with *C. pneumoniae* may affect the risk of cardiovascular disease. Animal models have shown that *C. pneumoniae* easily gains access to the vascular system following pulmonary infection. Infection of endothelial or smooth muscle cells in vessel walls may occur resulting in local inflammation and fibrosis and subsequent atheroma formation [6, 19].

**CONCLUSION**

From the above study results, it can be suggested that the lipid profile and CRP should be assessed during *Chlamydia pneumonia* infection, to rule out the cardiovascular complications in children as well as in adults.

**CONFLICT OF INTEREST STATEMENT**

The authors declare that they have no competing interests.

**REFERENCES**


Cite this article as: