Study on the effect of Industrial Pollution on Liver Profile in People Living in and Around Industrial Areas

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Abstract

The study includes investigations on liver parameters such as total bilirubin, direct bilirubin, SGOT, SGPT, ALP, total protein, albumin, etc., in people living in and around bollarum industrial area, Hyderabad who are exposed to various industrial pollutants. The subjects were divided in to 4 age groups of <20, 21-40, 41-60 and above 60 years and the results were compared with control group. Results showed significantly higher (p<0.05) levels of total bilirubin, direct bilirubin, SGOT, SGPT and ALP in subjects compared to controls which indicate the adverse effect of the industrial pollutants on liver in people living in and around the industrial area.

Keywords: SGPT, SGOT, ALP, Bilirubin, Liver, Industrial Pollutants

Introduction

Industries are one of the leading causes of pollution worldwide. Industrial pollution hurts the environment in a range of ways, and it has a negative impact on human lives and health. Pollutants can kill animals and plants, imbalance ecosystems, degrade air quality radically, and generally degrade quality of life (1). Factory workers and people living near the industrial areas with uncontrolled industrial pollution are especially vulnerable. Epidemiological studies on Industrial workers are important to understand health problems and genetic effects in workers exposed to chemicals at the work environment. Studies carried out all over the world established ill health effects, cytogenetic and DNA damage in the industrial workers (2,3). It is also highly pertinent to understand the health problems in people living in and nearby industrial areas.

Liver is one of the most important human organs which are responsible for the metabolism of drugs and toxic chemicals. Toxic metabolites generated through the metabolism are the main cause of liver damage. So liver is badly affected by industrial pollution. The epidemiological studies carried out revealed malfunction or liver damage in people living near industrial sites due to exposure to industrial pollutants (4). Hence the present study was aimed to investigate the liver parameters in blood of the people living in and around bollarum industrial area, Hyderabad.

Various epidemiological studies revealed that fine particles are associated with most health problems, such as cardiac and pulmonary diseases (5, 6, 7), diabetes (8), premature birth and low birth weight (9), cancer (10) and non-alcoholic fatty liver disease (11). Much like particulate matters, ambient SO\(_2\) concentration was associated with mortality, lung cancer, respiratory diseases (12, 13) and stillbirths (14). Further, the ambient NO\(_2\) concentrations were associated with pulmonary defects (15, 16), cardiovascular complications (17), mortality (18) and offspring’s birth weight (19). The serum enzymes SGPT, SGOT and ALP levels were considered to be specific for hepatocellular damage with a few exceptions (20). Elevations of the serum SGOT were reported in viral hepatitis as well as other liver diseases (21, 22). SGPT and SGOT are the liver enzymes that catalyse the transfer of amino groups to form the hepatic metabolites pyruvate and oxaloacetate, respectively.

Both the SGPT and SGOT are released from damaged liver cells into the blood after hepatocellular injury or death leading to their higher concentration in serum (23). Till now, several investigations were done to study the effect of environmental pollutants on pulmonary diseases. Thus, in this study we have evaluated the impact of industrial pollutants on liver abnormality or injury of the population living near bollarum industrial area. The study carried out by Bai et al. (2004) (24) through haematoxylin eosin (HE) staining and transmission electron microscopy (TEM) study found that SO\(_2\) inhalation can cause liver injury. Likewise, exposure to
NO₂ also affects the microsomal electron-transport systems in the liver.

**Materials & methods**

The Study was carried out in people living in Bollaram Industrial area, Hyderabad which is well known for both small scale and large industries. This area was taken as experimental site, because of the magnitude of the environmental problems due to liberation of indiscriminate industrial effluents.

**Collection of blood**

Blood samples were drawn from the people living in and around the industrial area (study subjects) and from people living in the outskirts of the city and away from industrial zone (controls). 5ml of intravenous blood was drawn from both the study and control subjects in to plain vacutainer tubes (Clot activator tube). The samples were transported to the laboratory in a chiller ice box (Tarson) at 0ºC, centrifuged and collected serum immediately for liver profile. Nitrile gloves were used throughout the sampling procedure to prevent any kind of infection.

**Analysis For liver profile**

Blood samples were analysed for liver profile to determine the possible effect of exposure on liver in people living in industrial area.

Total and direct bilirubin levels were estimated by modified Jendrassik and Grof's method (End Point) at 540nm, SGOT and SGPT enzyme levels by modified IFCC (UV Kinetic) method at 340nm, ALP levels by PNPP DEA method at 405nm, total protein levels by Biuret method (End point) at 540nm and albumin levels by BCG method (End point) at 620nm. All these parameters were estimated by using semi auto analyser (Microlab 300).

**Statistical analysis**

The association of total bilirubin, direct bilirubin, SGOT, SGPT, ALP, total Protein, albumin with the exposed/unexposed population was determined by Student’s t-test. The results were analysed by using student t-test (Medcalc software) to determine the significance of differences between the controls and subjects.

**Results**

The values of liver profile of the people living in industrial area (bollarum, Hyderabad) are compared with the normal people who are residents of other town where no industries are located are shown in table 1.

**Table 1** Liver profile analysis of people living in and around the industrial area and non-industrial area

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Investigation</th>
<th>&lt; 20 YEARS</th>
<th>21- 40 YEARS</th>
<th>41 -60 YEARS</th>
<th>&gt; 60 YEARS</th>
<th>ALL AGE GROUPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Controls</td>
<td>Subjects</td>
<td>Controls</td>
<td>Subjects</td>
<td>Controls</td>
</tr>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td></td>
<td>N=10</td>
<td>N=17</td>
<td>N=49</td>
<td>N=97</td>
<td>N=33</td>
<td>N=10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=3</td>
<td>N=154</td>
<td>N=150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Total Bilirubin (mg/dl)</td>
<td>0.734±0.116</td>
<td>0.908±0.446</td>
<td>0.734 ± 0.116</td>
<td>0.906 ±0.445*</td>
<td>0.734±0.116</td>
</tr>
<tr>
<td>2</td>
<td>Direct Bilirubin (mg/dl)</td>
<td>0.139±0.036</td>
<td>0.220±0.226</td>
<td>0.139 ± 0.036</td>
<td>0.220 ± 0.226*</td>
<td>0.139±0.036</td>
</tr>
</tbody>
</table>
Table I shows the comparison of liver profile values of subjects and controls in different age groups. Almost all the liver parameters viz., total bilirubin, direct bilirubin, SGOT, SGPT, ALP, were raised in the subjects when compared to the controls. The mean values of all the liver parameters are high in the subjects when compared to controls. The increase is high in case of total bilirubin (0.906±0.446 in subjects 0.734±0.116 in controls) direct bilirubin (0.220±0.227 in subjects and 0.139±0.036 in controls) ALP (200.5±67.45 in Subjects, 189.4±30.765 in controls), SGPT (25.367±10.83 in subjects, 22.496±6.383 in controls), SGOT (27.019±8.956 in Subjects in 22.31±6.113in Controls).

The statistical analysis of the results showed that the differences for total bilirubin, direct bilirubin, ALP, SGOT, SGPT were found to be significant (p<0.05) between the subjects and the controls. However the differences in total proteins and albumin between the two groups are not significant. The age wise analysis of the subjects for the above parameters carried out also showed significant differences for the above parameters except in <20 years,>60 age group where none of the liver profile parameters showed an increase.

### Discussion

The present study carried out in Bollarum Industrial area showed significant adverse effect on liver function in people living in and around the industrial area. Some people were the employees in various industries and had direct contact with the chemicals that are used in their respective industries. Some others were the residents of this area but had no direct contact. It is possible that these people are indirectly exposed to the industrial pollution as they have been living in this area. The industrial waste was let in to small canals in and around this industrial area and hence the inhabitants or residents living in this area are at high risk. The results of the present study were compared with the earlier studies which were carried out on Industrial workers for liver abnormalities.

Muhammad Mashhood Ahsan et al. (2006) (25) also showed liver damage in tannery workers. They observed an increase in ALP in the 21-40 years age group and a significant decrease in ALP in young (1-20 years) and old age group (41- 60 years) tannery workers. They also observed an increase in the SGOT, SGPT values in the workers compared to control population. Tapan Dey et al
(2015) (26) evaluated the impact of air pollutants such as NO\textsubscript{2}, RSPM and SPM present in air surrounding the oil drilling sites on liver abnormality or injury of the population living near those sites. The study found that the presence of air pollutants in the environment does play an important role in liver abnormality or injury to the inhabitant as compared to control groups residing in non-industrial area. The study carried out by Bai et al. (2004) (27) through haematoxylin eosin (HE) staining and transmission electron microscopy (TEM) analysis found that SO\textsubscript{2} inhalation can cause liver injury. They also indicated exposure to NO\textsubscript{2} also affects the microsomal electron-transport systems in the liver (28). Modhir et al. (2014) (29) also showed an increase in albumin in female cement workers as compared to control group indicating liver abnormality. Aydin et al. (2010) (30) observed association of occupational cement dust exposure with an increased risk of liver abnormalities, pulmonary disorders and carcinogenesis and decreased antioxidant capacity. Jong Won Kim et al., (2014) (31) study provided ample evidence on the role of air pollutants on liver diseases in man and also in animal models.

The ill effects on liver might be attributed to joint effect of industrial pollutants and hence the management of the industries have to take appropriate measures to control the environmental pollution due to industrial wastes. The results of the present study showed adverse effect on liver and further studies are warranted on a large sample size to derive definite conclusions.

**Conclusion**

People who are living in and around industrial area are frequently exposed to various industrial pollutants and these pollutants have significant impact on liver function and liver damage. Thus the study suggested that long term exposure to the industrial chemicals and stay in industrial residential area might cause liver abnormalities in the population.

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