Rapid Communication

Histopathologic Findings of Bone Marrow Induced by 2-Bromopropane in Male Rats

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2-Bromopropane may have potential genital and hematopoietic toxicity in humans. This solvent is used as an alternative of chlorofluorocarbons. From the recent report in Korea4, of 33 workers (8 men and 25 women) who were working in the production of electronic machine components (Tact Switch), using 2-bromopropane, 16 people (64%) had amenorrhea, two had azoospermia and four had oligozoospermia or reduced sperm motility; eight women and one men also had pancytopenia. These disorders were not seen among workers who were not exposed to the 2-bromopropane. More than 1,100 workers, who were working in the production of electronic machine components, confirmed the testicular toxicity of 2-bromopropane in animals by inhalation exposure ranging between 0–3,000 ppm: the chemical-induced damage by 2-bromopropane in animals by inhalation exposure ranging between 0–3,000 ppm: the chemical-induced damage

Analysis of variance was performed. Tukey-Kramer’s multiple comparison method was used under the null-hypothesis that there is no significant difference between groups. The 0.05 level of probability was the criterion of significance.

Results

In control rats, numbers of adipose cells were 174 ± 77 / mm2 (Table 1), a value similar to those of the group exposed to 300 ppm 2-bromopropane: the exposure to 300 ppm 2-bromopropane did not influence numbers in the bone marrow. On the other hand, exposure to 2-bromopropane at 1,000 ppm or higher dose-dependently increased the numbers of adipose cells accompanied by the decrease in hematopoietic cells. In the group exposed to 1,000 ppm 2-
granulocytes to erythrocytes (1.77 ± 0.65 and 1.77 ± 0.65, respectively). It is noticed that the size of adipose cells in 3,000 ppm exposed group was smaller than that in 1,000 ppm data not shown), in good agreement with the result from HE stained sample. Residual bone marrow cells showed morphologically minimal change in each lineage. Exposure to 300 ppm 2-bromopropane did not influence the number of megakaryocytes, but exposure to 1,000 ppm or higher did decrease the numbers. The cessation of exposure to 3,000 ppm 2-bromopropane for more than seven weeks led to a decrease in the numbers of adipose cells when compared to those in the group killed immediately after the exposure, but not to the level of 1,000 ppm- or lower-exposed groups. In addition, this cessation seemed to diminish the size of adipose cells (data not shown).

Table 1. Effects of exposure to 2-bromopropane on the number of megakaryocytes and adipose cells in rat bone marrow

<table>
<thead>
<tr>
<th>2-bromopropane (ppm)</th>
<th>n</th>
<th>No. of megakaryocytes (×10^3/mm³)</th>
<th>No. of adipose cells (×10^3/mm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9</td>
<td>74 ± 17</td>
<td>174 ± 77</td>
</tr>
<tr>
<td>300</td>
<td>9</td>
<td>66 ± 16</td>
<td>186 ± 66</td>
</tr>
<tr>
<td>1000</td>
<td>9</td>
<td>39 ± 12c,d</td>
<td>479 ± 86c,d</td>
</tr>
<tr>
<td>3000</td>
<td>3c</td>
<td>21 ± 13c,d</td>
<td>1166 ± 224c,d,e</td>
</tr>
<tr>
<td>(6)</td>
<td></td>
<td>(51 ± 11c)</td>
<td>(629 ± 77c,d,e)</td>
</tr>
</tbody>
</table>

Rats were exposed to 2-bromopropane for 11 days, and then killed 16–17 hr after the last exposure. Rats were exposed to 2-bromopropane for 9–10 days and then exposed to fresh air for 7.5 weeks. Significantly different from control (p<0.05). Significantly different from group exposed to 300 ppm of 2-bromopropane. Significantly different from group exposed to 1,000 ppm of 2-bromopropane. Significantly different from group exposed to 3,000 ppm of 2-bromopropane for 11 days, and then killed 16–17 hr after the last exposure.

Discussion

We reported that 2-bromopropane caused genital organ damage in male rats[1,3]. In the present study, exposure to 2-bromopropane led to a hypocellular bone marrow: there might be a decrease in numbers of hematopoietic cells, and the thus induced bone marrow hypoplasia might develop pancytopenia. These results clearly indicate that 2-bromopropane has the potential for genital organ and hematotoxicity. The pattern of anemia may be a slightly macrocytic[3]. These results also support the hypothesis that oligozoospermia and anemia observed in humans who work with electronic machine components in Korea[1] resulted from the exposure to 2-bromopropane.

2-Bromopropane at 300 ppm or higher induced testicular damage. In contrast, hematotoxicity caused by this solvent was not seen at this concentration. Thereby the testicles are more vulnerable to 2-bromopropane than is the bone marrow. Similar findings were also seen in workers in Korea[10]; oligozoospermia or amenorrhea occurred in 70% of the workers, but hematotoxicity only in 23%; all workers who had anemia also had amenorrhea or oligozoospermia, but no worker had anemia alone.

References