HEMATOLOGICAL EFFECTS OF SILVER NITRATE ON ALBINO RATS

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Abstract

This experiment aimed to investigate the Hematological effect of silver nitrate on the albino rats' blood. Twenty-eight adult rats were used in this experiment. After acclimatization for three weeks they were divided equally into 4 groups as follows; control Group normal diet and water for six weeks (n=7 rats), T1 group silver nitrate 156.6 mg/Kg B.W (1/10 LD50)(n=7 rats). And T2 Group 156.6 mg /Kg B.W Silver nitrate and 500 mg/kg BW Vit. C daily for 6 weeks (n=8 rats) and T3 group 500 ml/Kg B.W Vit. C daily for 6 weeks. After 6 weeks, One-milliliter blood was mixed in 10% EDTA anticoagulant and analyzed for complete blood count (CBC). Differences in hematological and plasma biochemical parameters were observed for the AgNO₃ treated groups compared with those of the controls. Decrease RBC and Hb, an increase of WBC indicated increasing immunogenic response in treated animals.

Key words : silver nitrate, vitamin C, hematology, rat.

Introduction

Silver nitrate (silver nitric acid 1 + salt) is a powerful oxidizing agent produced in dilute nitric acid by dissolving silver and evaporating the solnum. The residue is heated to a dull red color for the decomposition of any copper nitrate, dissolved in water, filtered, and re crystallized (Lewis et al., 1997). Used in the manufacture of mirrors; photography; other silver salts; silver plating; hair dyeing; in sympathetic and indelible inks; porcelain coloring; ivory etching; as a very important and widely used reagent in analytical chemistry; (O’Neil, 2001). Discovered in the 13th century, by Albertus Magnus (Szabadváry & Ferenc1992). During the 1800s silver was used in dentistry, wound care, and medical devices as an antiseptic for post-surgical infections.

Silver nitrate has been used for various medical therapies and infectious diseases, even before the scientific understanding of pathogenic species that cause disease (Klasen, 2000). In 1881, Crede introduced the prevention of ophthalmia neonatorum in newborns using a 2 percent silver nitrate solution (Klasen, 2000).

Silver nitrate was used as a disinfectant for eye disease and burnt wounds for medical use. Although medical use of silver nitrate as a disinfectant became a subsidiary with antibiotic discovery, its use in caries treatment also decreased with the use of fluoride in caries prevention. (Sherry et al., 2017).

Because of its broad range of antibacterial activity, lack of bacterial resistance, and low toxicity it has long been a popular antimicrobial agent for medical use. However, the use of silver nitrate became a subsidiary with the introduction of penicillin and other antibiotics in the 1950s (Atiyeh et al., 2007). In some studies silver nitrate used for treatment of cutaneous leishmaniosis (Kadir, 2006). In wound care, treatment of allergic contact dermatitis ulcerative colitis and cystitis, the anti-inflammatory effects of silver nitrate or nanocrystalline silver have been experimentally recognized (Nadworny et al., 2003 and Wright et al., 2002).

Silver nitrate (0.5 %) evoked an increased level of cellular apoptosis but delayed the healing of wounds. Administration of 4 mg·kg⁻¹ nanocrystalline silver intercolonially or 40 mg·kg⁻¹ orally significantly reduced inflammatory changes in a rat model of ulcerative colitis, partly by suppression of matrix metalloproteinase (MMP-9), tumor necrosis factor (TNF), and interleukin-² (IL-²) and IL-12 (Bhol and Schechter, 2007).
Hematological effects of silver nitrate on Albino Rats

Materials and Methods

Silver nitrate will be administered to two groups of rats daily oral in a dose of 1/10 LD50 (G1), and 1/10 LD50 with vitamin C (G2) individually and vitamin C only G3 and D.W. for control for 6 weeks. The animals were sacrificed after 6 weeks. LD50 was calculated to be 1566 mg/kg (Manna S et al., 2005). This experiment aimed to examine the hematological effect of silver nitrate administration on adult rats.

Experimental animals

This study included (28) albino rats aged approximately three months and body weight ranged from (150-200 g) to perform this experiment. The animals were raised and bred at the College of Veterinary Medicine / University of Baghdad’s animal house where the research was conducted. The animals were kept for acclimatization in optimum breeding conditions at (22 ± 3) °c with a (14/10) Hours (Light / Dark) cycle in cages of (20 * 30 * 50) cm³ dimensions in an average of three rats in each cage one month before the study. Commercial pellets of feed and drinking water were given all the time (Hafes, 1970).

After acclimatization, they were divided equally into three groups as follows:

1. Control (Normal diet and water for 6 weeks (7 rats)
2. Group- T₁ (silver nitrate 1/10 of LD50 (156.6 mg/kg BW) for 6 weeks (7 rats)
3. Group- T₂ (silver nitrate 1/10 of LD50 (156.6 mg/kg bw) for 3 weeks and (vitamin C 500 mg/kg bw) for 3 weeks (7 rats)
4. Group – T₃ (vitamin C 500 mg/kg BW)

Blood samples were collected at various intervals of the experiment using disposable medical syringes (5ml) via cardiac puncture. For full blood count, one milliliter of blood was blended into 10 % EDTA anticoagulant and analyzed.

Table 1: Showed treated groups with sliver nitrate and vitamin C compared with control group changes on (WBC, Lymphocytes, Hb and RBC).

<table>
<thead>
<tr>
<th>Param.</th>
<th>WBC</th>
<th>Lymph</th>
<th>Lymph%</th>
<th>Hb</th>
<th>RBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>3.80±0.24c</td>
<td>3.12±0.23bc</td>
<td>41.22±4.23b</td>
<td>15.20±0.41a</td>
<td>4.56±0.90a</td>
</tr>
<tr>
<td>T₁</td>
<td>15.34±1.74a</td>
<td>8.84±0.73a</td>
<td>72.20±5.46a</td>
<td>8.36±0.70b</td>
<td>1.19±0.25c</td>
</tr>
<tr>
<td>T₂</td>
<td>8.03±1.49bc</td>
<td>4.16±0.21b</td>
<td>63.13±9.24ab</td>
<td>8.96±0.66b</td>
<td>2.28±0.41bc</td>
</tr>
<tr>
<td>T₃</td>
<td>11.22±2.40ab</td>
<td>3.90±0.40bc</td>
<td>58.73±6.12ab</td>
<td>9.70±0.41b</td>
<td>1.58±0.44c</td>
</tr>
<tr>
<td>LSD</td>
<td>5.5397</td>
<td>1.4726</td>
<td>23.574</td>
<td>1.9272</td>
<td>1.7688</td>
</tr>
</tbody>
</table>

Means with a different letter in the same column are significantly different (P<0.05).

Table 2: Showed treated groups with sliver nitrate and vitamin C compared with control group changes on (HCT, MCV, MCH, MCHC, RDW-CV).

<table>
<thead>
<tr>
<th>Param.</th>
<th>HCT</th>
<th>MCV</th>
<th>MCH</th>
<th>MCHC</th>
<th>RDW-CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>39.76±2.08a</td>
<td>66.36±2.78</td>
<td>27.10±2.44a</td>
<td>33.56±1.24</td>
<td>14.74±1.49b</td>
</tr>
<tr>
<td>T₁</td>
<td>7.76±1.13c</td>
<td>71.56±7.55</td>
<td>19.52±1.13b</td>
<td>25.68±2.10</td>
<td>23.90±2.81ab</td>
</tr>
<tr>
<td>T₂</td>
<td>18.50±1.29bc</td>
<td>72.60±1.250</td>
<td>19.36±1.66b</td>
<td>26.36±5.84</td>
<td>24.80±6.36a</td>
</tr>
<tr>
<td>T₃</td>
<td>20.23±5.59bc</td>
<td>67.36±7.66</td>
<td>17.13±2.82b</td>
<td>26.70±6.78</td>
<td>22.16±3.44ab</td>
</tr>
<tr>
<td>LSD</td>
<td>15.058</td>
<td>21.46NS</td>
<td>5.7986</td>
<td>10.23NS</td>
<td>9.7974</td>
</tr>
</tbody>
</table>

Means with a different letter in the same column are significantly different (P<0.05).

Table 3: Showed treated groups with sliver nitrate and vitamin C compared with control group changes on (RDW-SD, PLT, MPV, PDW, PCT).

<table>
<thead>
<tr>
<th>Param.</th>
<th>RDW-SD</th>
<th>PLT</th>
<th>MPV</th>
<th>PDW</th>
<th>PCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>44.12±2.61</td>
<td>542.00±24.21abc</td>
<td>7.98±0.54</td>
<td>15.20±0.80b</td>
<td>0.26±0.06</td>
</tr>
<tr>
<td>T₁</td>
<td>47.96±9.38</td>
<td>698.20±87.65a</td>
<td>8.38±0.31</td>
<td>17.42±0.38a</td>
<td>0.42±0.06</td>
</tr>
<tr>
<td>T₂</td>
<td>35.96±1.63</td>
<td>684.33±71.38ab</td>
<td>8.06±0.33</td>
<td>17.06±0.57ab</td>
<td>0.44±0.08</td>
</tr>
<tr>
<td>T₃</td>
<td>38.36±2.63</td>
<td>502.80±61.33bc</td>
<td>8.23±0.53</td>
<td>17.03±0.62ab</td>
<td>0.44±0.01</td>
</tr>
<tr>
<td>LSD</td>
<td>22.355NS</td>
<td>191.09</td>
<td>1.2898NS</td>
<td>2.0073</td>
<td>0.1908NS</td>
</tr>
</tbody>
</table>

Means with a different letter in the same column are significantly different (P<0.05).
Results

Rat treated with AgNO₃ compared to those of controls, significantly decreased red blood cells (RBC) hemoglobin concentration (HB) hematocrit (HCT) and mean corpuscular hemoglobin (MCH), increased WBC indicated an increased immunogenic response in treated animals. In T₂ treated group PLT increased but in Vit C normal. Community and control group handled in vit C. T₂ treated group show the slight protective role of vitamin C. T₂ and T₃ showed increase in white blood cells (WBC), number of lymphocyte (lymph), percent of lymphocyte (lymph%), mean corpuscular volume (MCV), red cell distribution width -coefficient variation (RDW-CV), red cell distribution width-standard deviation (RDW-SD), platelets count (PLT), mean platelet volume (MPV), platelet distribution width (PDW) and procalcitonin (PCT). All blood parameter changes seen in tables below.

Discussion

Differences in hematological and plasma biochemical parameters for the AgNPs and AgNO₃ treated rats were observed (Guangqiu et al., 2016), in female rats treated with 0.5 mg kg⁻¹ AgNO₃, RBC increased compared with control (P<0.05), the only hematological and plasma biochemical parameters affected in females treated with AgNO₃ (Guangqiu et al., 2016). Hematological responses were significantly influenced by oral administration of AgNPs with increased RBC and WBC compared with the relatively low toxicity in body weight and food consumption and decreased PLT. Increase in RBC suggesting a greater need to transport oxygen (Hadrup and Lam, 2014) while the increase in WBC in these animals indicated an increasing immunogenic response (Shin et al., 2007 and Kim et al., 2009) Fluctuations in these blood parameters have indicated improvements in the processes underlying the physiology of the blood under AgNPs stress (Hadrup and Lam, 2014). Regarding the AgNO₃, the only hematological parameter observed to be affected by AgNO₃ was RBC in the female 0.5 mg kg⁻¹ group. In previous rat studies, a higher oral dose (9 mg kg⁻¹) of ionic silver did not affect hematological parameters (Hadrup et al., 2012a).

Conclusion

Silver nitrate (AgNO₃) is suspected to cause anemia by decreasing HB and RBC in blood in the albino rat. Vitamin C has a slight protective and treatment role in AgNO₃ exposed rats.

References


