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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 groupsilver nitrate 156.6 mg/Kg B.W (1/10 LD50)(n=7 rats). AndT2 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 $AgNO_3$ 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 Wrigh *et al.*, 2002).

Silver nitrate (0.5 %) evoked an increased level of cellular apoptos is but delayed the healing of wounds. Administration of 4 $mg \cdot kg^{-1}$ nanocrystalline silver intercolonially or 40 $mg \cdot kg^{-1}$ 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).

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) cm^3 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- T_1 (silver nitrate 1/10 of LD50 (156.6 mg/kg BW) for 6weeks (7 rats)
3. Group- T_2 (silver nitrate 1\10 of LD50 (156.6 mg/kgbw) for 3 weeks and (vitamin C 500mg\kg bw) for 3 weeks (7 rats)
4. Group –T_3 (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).

Param.	WBC	Lymph	Lymph%	Hb	RBC
Control	3.80±0.24c	3.12±0.23bc	41.22±9.23b	15.20±0.41a	4.56±0.90a
T_1	15.34±1.74a	8.84±0.73a	72.20±5.46a	8.36±0.70b	1.19±0.25c
T_2	8.03±1.49bc	4.16±0.21b	63.13±9.24ab	8.96±0.66b	2.28±0.41bc
T_3	11.22±2.40ab	3.90±0.40bc	58.73±6.12ab	9.70±0.41b	1.58±0.44c
LSD	5.5397	1.4726	23.574	1.9272	1.7688

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).

Param.	HCT	MCV	MCH	MCHC	RDW-CV
Control	39.76±2.08a	66.36±2.78	27.10±2.44a	33.56±1.24	14.74±1.49b
T_1	7.76±1.13c	71.56±7.55	19.52±1.13b	25.68±2.10	23.90±2.81ab
T_2	18.50±12.94bc	72.60±12.50	19.36±1.66b	26.36±5.84	24.80±6.36a
T_3	20.23±5.59bc	67.36±7.66	17.13±2.82b	26.70±6.78	22.16±3.44ab
LSD	15.058	21.46NS	5.7986	10.23NS	9.7974

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).

Param.	RDW-SD	PLT	MPV	PDW	PCT
Control	44.12±2.61	542.00±24.21abc	7.98±0.54	15.20±0.80b	0.26±0.06
T_1	47.96±8.38	698.20±87.65a	8.38±0.31	17.42±0.38a	0.42±0.06
T_2	35.96±1.63	684.33±71.38ab	8.06±0.33	17.06±0.57ab	0.44±0.08
T_3	38.36±2.63	502.80±61.33bc	8.23±0.53	17.03±0.62ab	0.44±0.01
LSD	22.355NS	191.09	1.2898NS	2.0073	0.1908NS

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

Results

Rat treated with $AgNO_3$, 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 T_1 treated group PLT increased but in Vit C normal. Community and control group handled in vit C. T_2 treated group show the slight protective role of vitamin C. T_1 and T_2 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 $AgNO_3$ treated rats were observed (Guangqiu *et al.,* 2016), in female rats treated with 0.5 mg kg 21 $AgNO_3$, RBC increased compared with control ($P<0.05$), the only hematological and plasma biochemical parameters affected in females treated with $AgNO_3$ (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 cells under AgNPs stress (Hadrup and Lam, 2014). Regarding the $AgNO_3$, the only hematological parameter observed to be affected by AgNO3 was RBC in the female 0.5 mg kg 21 group. In previous rat studies, a higher oral dose (9 mg kg21) of ionic silver did not affect hematological parameters (Hadrup *et al.,* 2012a).

Conclusion

Silver nitrate ($AgNO_3$) 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 $AgNO_3$ exposed rats.

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